PETROLEUM PROCESSING

including Petrochemical Processing Section

APRIL 1953

Trends in Residuals

Long range market looks good, NPC says—p. 521

'Vis' Standards Change

New value for viscosity of water affects ASTM standards—p. 525

New Words to You?

Introducing a feature to define new petrochemical words for you—p. 553

New Tray Design

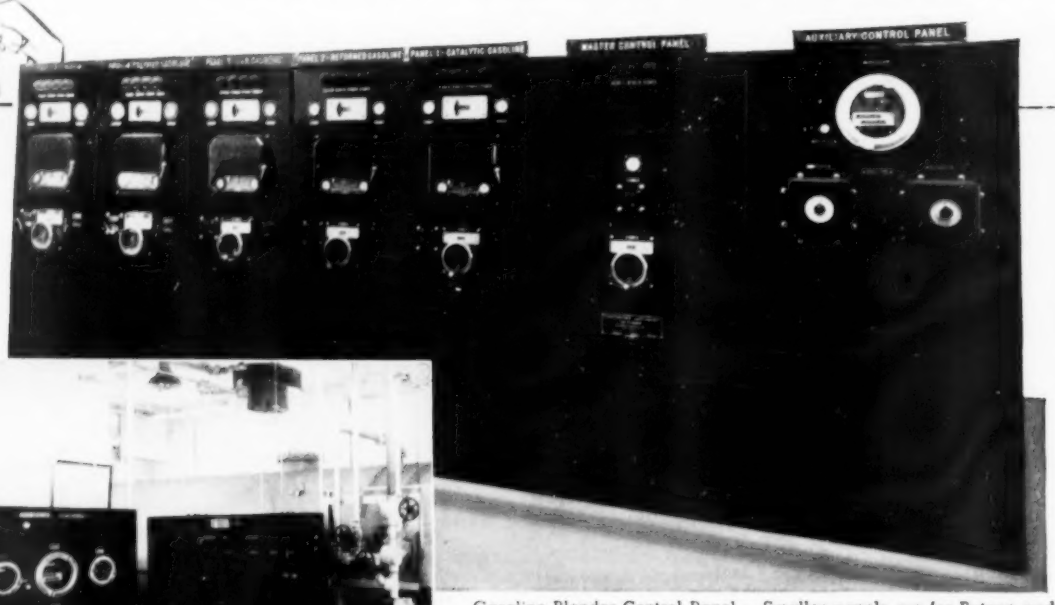
Directional perforations for greater efficiency in fractionation—p.556

Your API Refining Division

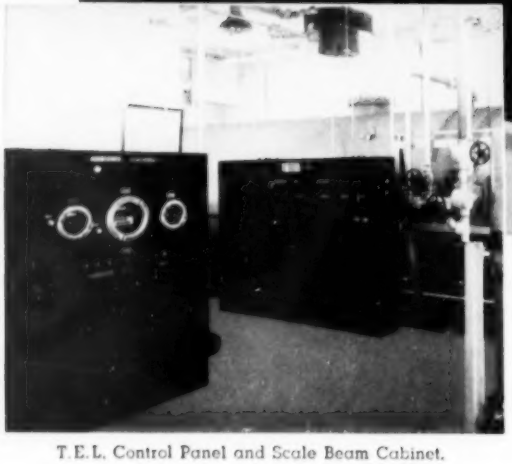
- Mid-Year Meeting Program . . . . . p. 526
- Special Industry Projects . . . . . p. 527
- Annual Committee Reports . . . . . p. 531
- Analytical Research . . . . . p. 536

A New Pace in Gasoline Blending

%PROPORTIONEERS% System Provides NEW Speed, Flexibility and Economy in the Production of Uniform Blends . . . . . .



Gasoline Blender Control Panel — Smaller panels are for Butane and Catalytic, Reformed, Light Straight Run and Polymer Gasolines; larger panels for Master and Auxiliary Control.



T.E.L. Control Panel and Scale Beam Cabinet.

External Piping Manifold.

This new plant of Canadian Oil Refineries, Ltd., at Sarnia, Ontario, employs high capacity automatic, continuous equipment to blend six components of its famous White Rose Products at rates up to 2,880 barrels per hour (2,000 G.P.M.). %Proportioneers% in-line blending provides accurate control of product quality, conserves manpower and plant space, and permits vastly increased production at reduced costs. Heart of the blending system is the %Proportioneers% Synchro-Master or differential unit which automatically maintains each component at its correct preset flow rate. Two or more components can be combined in any proportion and the formula is automatically maintained regardless of variations in the rate of total flow to storage tanks, ships or tank cars.

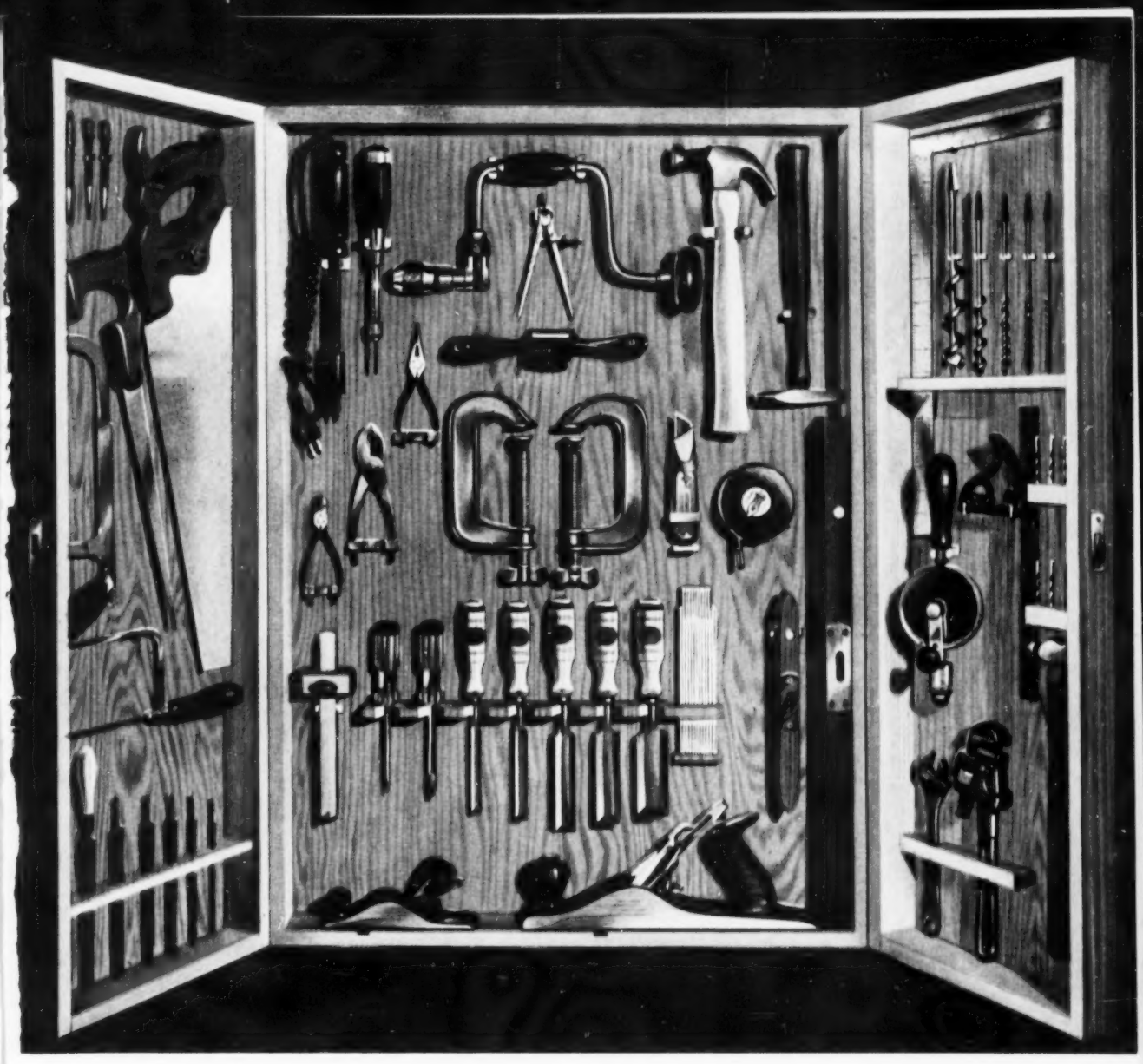
Ask for recommendations and descriptive literature.

See us at Booths 83–85 at the Oil Show in Tulsa

%PROPORTIONEERS, INC.%

Write to %PROPORTIONEERS, INC.%, 447 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.



A tool chest that has everything

You can see at a glance that this handsome chest contains about everything you need to do a good job. It isn't quite so easy to picture the many "tools" in the Ethyl service chest. But it has everything you need, too. For Ethyl offers a set of time-tested tools . . . developed through thirty years of experience.

Take Ethyl's sales tools, for example. Continuous advertising of "Ethyl" gasoline over the past three decades has helped refiners establish the premium gasoline market as we know it today. Over the years billions of magazine, billboard, radio, television, and drive-in movie messages have been beamed to the motoring public. And to carry through at the point of sale, educational programs have been devised for dealers—such as the Product Sales Clinic, which has been attended by more than 62,000 dealers, salesmen, and marketing people.

(*Continued on next page*)

ETHYL
ETHYL CORPORATION

Printed in U.S.A.

A tool chest that has everything

(Continued from preceding page)

Special tools have been forged to meet the problems of specific markets. For example, Ethyl's farm program helps petroleum marketers sell more gasoline and lubricants for tractors — and Ethyl's fleet program is designed for the bus and truck field.

Ethyl has also developed precision tools to assist refiners to produce high-quality regular and premium fuels. Included are extensive Research Laboratories with twenty years of practical experience in fuel, engine and lubricant problems, a road testing program to prove laboratory findings under field conditions and a nation-wide gasoline testing program to keep you accurately posted on fuel trends.

What makes this set of service tools so valuable is that they are in the hands of experienced men. Ethyl has been in the antiknock business longer than anybody else . . . and it is our aim at all times to make available to our customers everything we have learned.

ETHYL CORPORATION

NEW YORK 17, NEW YORK

Ethyl service is backed by 30 years of antiknock experience

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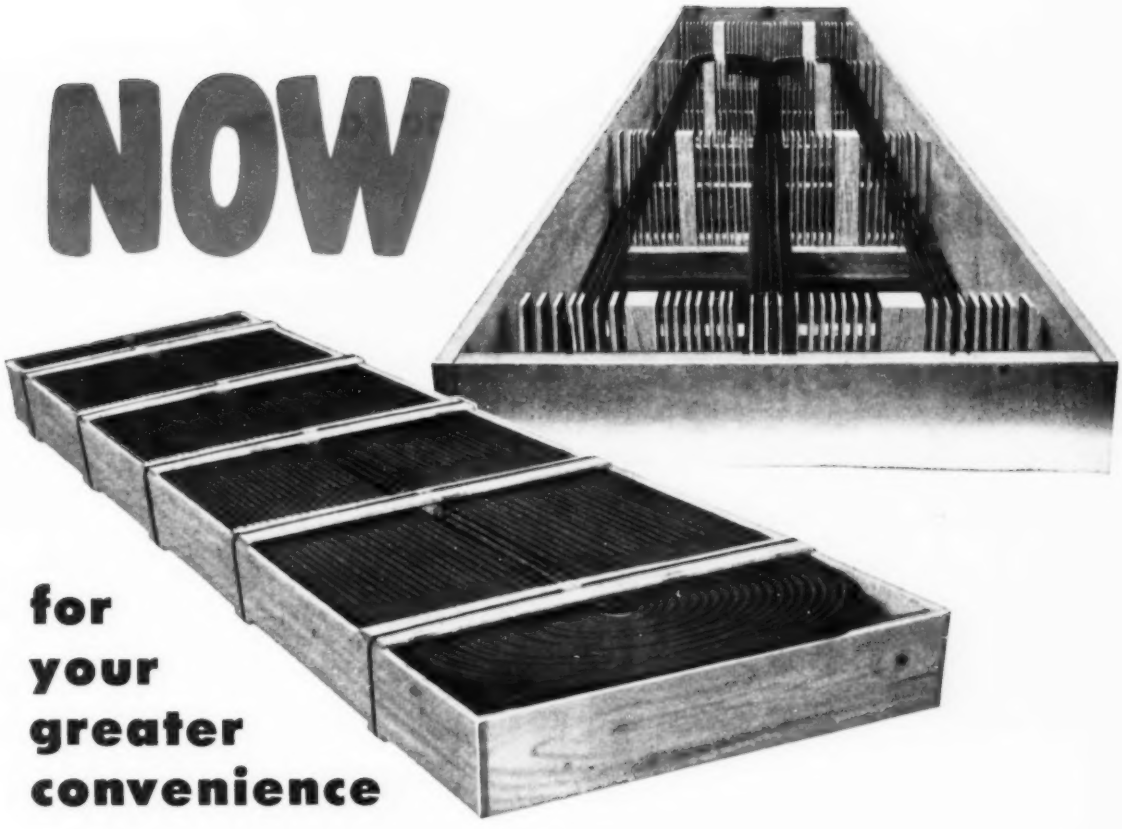

for your greater convenience

WOLVERINE BRINGS YOU "U-BEND" CONDENSER TUBES PACKAGED IN EXPENDABLE PALLETS . . .

The use of "U-Bend" — plain or finned — tube eliminates one tube sheet, rolling-in operations are reduced by one-half and floating head problems are eliminated.

This form of packaging saves you much time. Often a whole complement of tubes for condenser installation can be shipped in one pallet. All the tubes can be fed directly from the pallet type container into the condenser unit or the heat exchanger. Tube unloading, inspection, installation and handling costs are thus materially reduced.

Each pallet is designed and constructed to suit individual customer's needs and to withstand the abuses encountered in transit.

You'll save considerable time by keeping these unit pallets at hand as stand-bys. In this condensed package they occupy comparatively small storage space and can easily be stacked.

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of CALUMET & HECLA, INC.
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1425 CENTRAL AVENUE • DETROIT 9, MICHIGAN
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Plants in Detroit, Mich. & Decatur, Ala. Sales offices in Principal Cities

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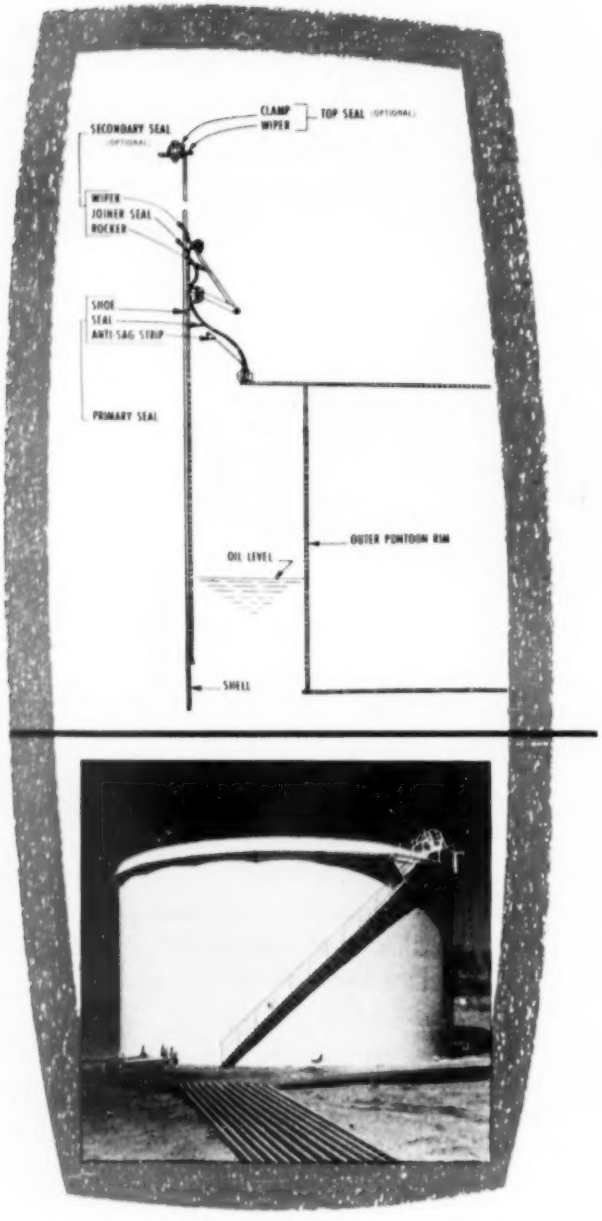
(To obtain more data on advertised products see page 600)

the important factors in **floating roof design**

number 1 of a series



Triple seal Protection!

top seal—stops vapor losses when roof is operating in upper 3 feet of tank. You get full tank capacity without increasing shell height. A patented Wiggins exclusive feature.

secondary seal—Neoprene-coated fabric ring and joiner curtain cuts costly wind losses. Saves 50% of evaporation losses suffered by tanks having only a single seal.

primary seal—long limber metal shoe assures positive, constant contact with tank shell—regardless of shell irregularities. Patented anti-sag device prevents accumulation of water and dirt in seal fabric.

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Pontoons
- divided into *gas-tight* compartments for safety
- deep and roomy for easy entrance, inspection and maintenance
- uncluttered with framework, easy to inspect

Drainage
- complete, clean drainage assures protection against peeling of paint, rusting, and dangerous accumulation of water

Strength
- roof designed to take *all loads* to which it may be subjected with a better than normal safety factor

Capacity
- full use of tank capacity for in and out storage

Only Wiggins floating roofs meet every important design specification

WIGGINS VAPOR SEALS GENERAL AMERICAN TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION

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(*To obtain more data on advertised products see page* 600)

PETROLEUM PROCESSING

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels lubricants and chemicals.

April, 1953
Vol. 8, No. 4

Contents

FEATURE ARTICLES

A Message to the Readers **447**

Refining Section

Where "Residuals" Are Heading **521**
Long range market looks good, *a staff report by the Editors*

Four Viscosity Standards Changed **525**

API Refining Division (Special Section) **526**
Mid-year Meeting Program 526
Electrical Installations in Refineries, *by Lester M. Goldsmith* 527
Pump Training Manual on Way 529
Steels Deterioration Is Studied 530
Committee Activities—1952 531
Analytical Research Abstracts 536

Help For You in Fractionator Design **539**
Part 2—Stripping and rectifying of ternary mixtures—partially distributed components, *by Robert R. White*

Refining in Mexico **544**
Part 3—How Pemex operates a refinery, *by D. P. Thornton, Jr.*

Radioactivity in the Refinery **551**
How tracers permit flow studies in vacuum still, *by G. C. Gester, Jr., R. D. Lee, and D. E. Hull*

Petrochemical Section

Do You Know These Words? **553**
A new feature introducing refinery men to new arrivals among the petrochemicals, *by B. H. Weil*

Spiral Flow for Better Distillation **556**
New fractionating tray design uses directional perforations

Properties of Ammonia . . . **562**
At high temperatures and pressures, *by Edward R. Grahl*

DEPARTMENTS

Publisher's Page 445
What's Happening 449
Tomorrow 453
Plant Practices 567
Lab Practices 571
Patents 573
Personals 581
Suppliers 587
Meetings 593
Operating Trends 597
Advertisers' Index 600
What's New 601
Literature Offered 613
Editorials 616

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PUBLICATION OFFICES
1213 West Third St., Cleveland 13, Ohio

Editorial Staff

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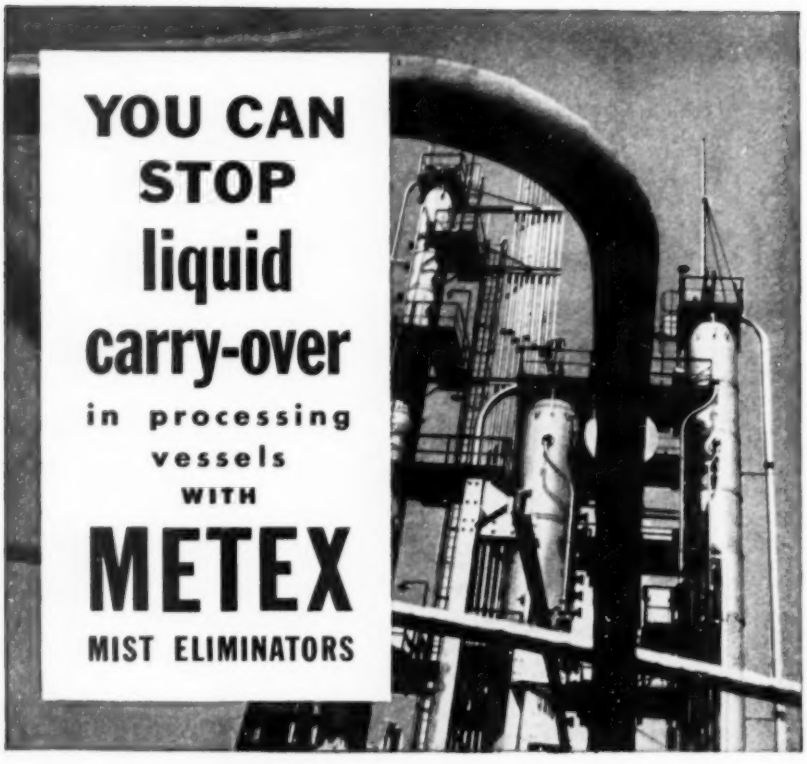

The unusually high efficiency with which these *knitted* wire mesh units remove the liquid entrainment that occurs in a wide variety of refining and processing operations has enabled engineers to:

1. Improve product quality and eliminate reruns.
2. Prevent contamination in subsequent operations.
3. Recover valuable products previously lost.
4. Operate existing equipment at higher capacities.
5. Design new equipment with smaller dimensions.
6. Achieve more economical processing of lower grade materials.
7. Secure longer "on-stream" periods by removing corrosive liquids.
8. Prevent air pollution by objectionable liquids.

METEX Mist Eliminators can be used *wherever* the problem of liquid entrainment exists. By effecting complete removal of liquids, Mist Eliminators contribute to more efficient and economical processing in such vessels as:

VACUUM PIPE STILLS	EVAPORATORS	COMPRESSORS
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Get the full facts on METEX Mist Eliminators

Write for bulletins giving detailed information — including limiting velocities, pressure drop, efficiencies, etc.

METAL TEXTILE CORPORATION

KNITTERS OF WIRE MESH FOR MORE THAN A QUARTER CENTURY

METEX

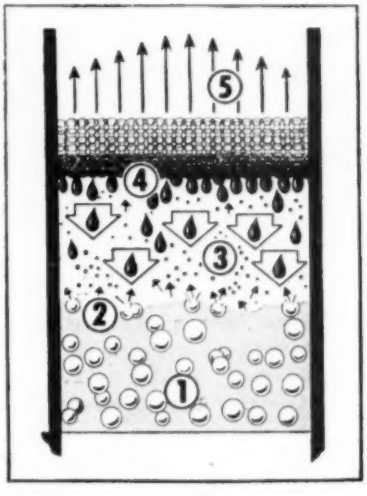
Main Office & Plant, Roselle, New Jersey Canadian Plant, Hamilton, Ont.

PADS OF KNITTED WIRE MESH WIPE OUT LIQUID ENTRAINMENT

Pads of uniform density, made from multiple layers of knitted wire mesh, have proved exceptionally effective in removing liquid entrainment from gases in a wide range of refining and processing operations.

The pad is placed inside a vessel above the liquid level. Its construction provides a multiplicity of unaligned, asymmetrical openings with unusually large wire-surface area. It is impossible for a gas to pass through the pad without continually changing direction; yet the high free volume—97 to 98%—minimizes restriction and pressure drop.

METHOD OF OPERATION



When a gas is generated in or passes through a liquid (1), it carries with it, as it bursts from the liquid surface (2), a fine spray of droplets of entrained liquid. These droplets are carried upward by the rising gas stream (3).

As the gas passes through the pad, the droplets impinge on the extensive wire surface (125 square feet of area per cubic foot of pad volume). The droplets coalesce on the wire surface to form large drops of liquid which break away (4) from the wire mesh and fall back against the gas stream. The gas (5) passes on, freed from liquid entrainment.

AVAILABILITY

The pads, which are known as METEX Mist Eliminators are made by Metal Textile Corporation, 631 East First Avenue, Roselle, N. J. A bulletin giving detailed information is available on request from the manufacturer.

(*To obtain more data on advertised products see page* 600)

PETROLEUM PROCESSING

Publisher's Page

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PUBLICATION OFFICES

1213 West Third St., Cleveland 13, Ohio

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R. H. Loyer, Circulation Manager
Robert E. Lessing, Production Manager
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Petroleum Processing is published second Tuesday of each month by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948) founder. Editorial, Advertising and Subscription Offices, 1213 West Third St., Cleveland 13, Ohio.

Executive Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Single copies, 75c; back copies more than three months old, $1.00 each. Subscriptions: United States and possessions, Canada and Latin America—$8.00 for one year, $12.00 for two years, $16.00 for three years; all other countries—$10.00 for one year, $16.00 for two years, $20.000 for three years. Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology. Acceptance under section 34.64 P.L.&R. authorized. Printed in U.S.A. Copyright 1953 by McGraw-Hill Publishing Co., Inc. All rights reserved.

Save Yourself a Trip to the Dictionary

TAKE "Hydrazine", for example. It's one of those unfamiliar words that bob up in the news and articles in PETROLEUM PROCESSING about the new compounds coming from petroleum and natural gas, and one we will probably run into more in talking about jet fuels.

Its not a new term, especially to the chemists and chemical engineers fresh enough out of college to remember some of the organic chemical compounds mentioned in the textbooks. Even to them, the word hydrazine has new significance today. The same for pyridine and pentaerythritol, just to mention a couple more.

To many readers in plants and offices with only a speaking acquaintance with chemistry and its terms, these are in effect new words. We could all go to the dictionary or encyclopedia, but even the chemical dictionaries don't give too much about them as petrochemical derivatives and their coming uses. Then there's always the inertia of the human flesh.

It was a Friendly Reader who stepped forward to help our Editors in this problem, as often is the case. "Why don't you run a column in PETROLEUM PROCESSING once in a while and tell us older readers something about these new words?" he asked. "Even tell us how to pronounce them." It looked like a good idea at first glance, and it soon had the o.k. of the Editors.

Then came the question of who could best write this feature, which already had a name "New Words in Your Reading." The job fell to a man who liked the idea and is well qualified far the assignment, B. H. Weil, head of the Information Division, Ethyl Corp.'s Research and Engineering Dept., Detroit. Ben is already a well known contributor to PETROLEUM PROCESSING. What he will write will be something more than a glossary and short of what an up-to-date encyclopedia would carry. As terms like hydrazine, pyridine and even newer ones shown in the text of articles, he will tell what sort of hydrocarbon compounds they are, how they are derived from gas or petroleum, and something of their anticipated future as petrochemicals. Oh, yes, and how to pronounce them.

You'll find the first installment of "New Words in Your Reading" on p. 553. We hope you like it. Even more, we hope you will send in words for Mr. Weil to write about, or give us other suggestions for improving our new feature.

Virgil Guthrie

For the Editors

Other Platt Petroleum Publications

National Petroleum News
The weekly oil marketing magazine, covering news, prices, transportation, storage, merchandising.

Platt's Oilgram News
A daily independent oil-news reporting service issued from New York, Cleveland and Houston

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The Superior Coating

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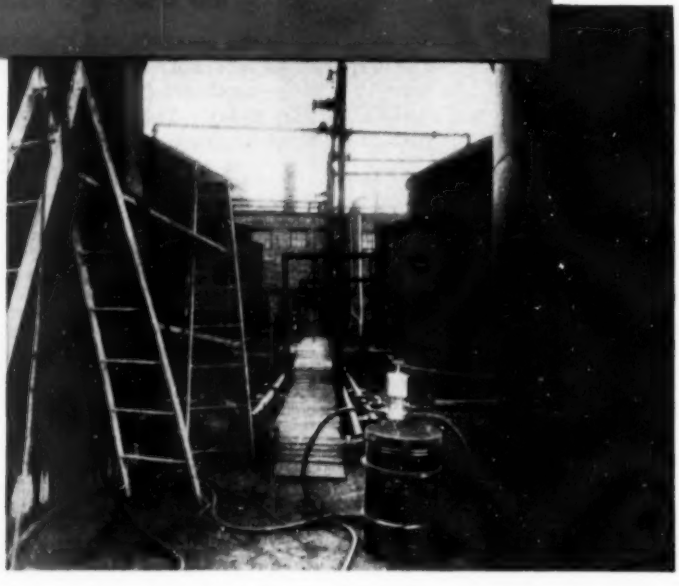
by a satisfied user
of fourteen years experience



In 1939 The Murphy Miles Co. in Chicago had the five oil storage tanks in the background above coated with INSUL-MASTIC TYPE "D", the coating that prevents corrosion and also insulates. Proof that this coating has given good, maintenance free service through the years came in 1952 when TYPE "D" was chosen again for coating the two tanks in the foreground.

These tanks are heated to keep the oil flowing freely and they *MUST* be protected from corroding. One coat of INSUL-MASTIC TYPE "D" does both jobs for Murphy Miles. This *Superior* Gilsonite coating contains 65% to 75% cork granules. This cork is sufficient insulation to prevent 65% heat loss from the tanks. No other coating is needed because TYPE "D" is also non-absorbent . . . It is a *Superior* grade of protective coating which will prevent moisture and chemicals from causing corrosion.

The fourteen years during which INSUL-MASTIC has protected these tanks is only a portion of its expected life. You, too, can depend upon INSUL-MASTIC TYPE "D" for long-life protection against corrosion on tanks, fractionation towers and other process equipment. Write for the name of your nearest INSUL-MASTIC Representative.

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INSULATION

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(To obtain more data on advertised products see page 600)

CURTIS W. McGRAW, Chairman and President of the McGraw-Hill Publishing Co., Inc.

A Message to the Readers Of *Petroleum Processing*

WITH this issue of PETROLEUM PROCESSING the McGraw-Hill Publishing Co. assumes responsibility for rendering to the petroleum industry the service that has been so well performed by Warren C. Platt and his associates for nearly half a century. To many of you, readers of this publication, McGraw-Hill is no stranger. You know something about our company, its resources, its world-wide organization, its magazines, its books and its related services in many departments of industry, engineering and education. It is not my desire to talk here about our company, what it has done or what it is doing.

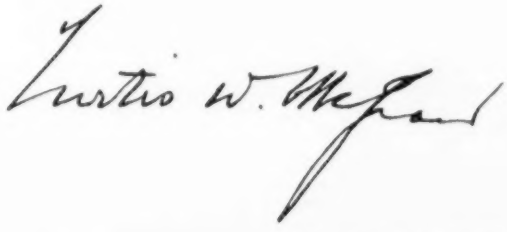
Rather do I wish to tell you, the men who are operating the great industry served by this publication, that we embark upon this new role with a keen sense of our responsibility and a purpose to put all of our resources to work for you. We know that we have a lot to learn about an unfamiliar industry and about you and your problems. For that reason we expect to devote a large part of our energies for some time to come to studying your needs and to learning how best we can help to serve them. In doing this, we are fortunate to have the continuing counsel of Warren Platt and the members of his organization. It is our hope that we shall be able to work with the oil men of today and tomorrow as effectively as they have been working with them heretofore.

This ambition poses a very real challenge to us. The petroleum industry, in all its functions, has made giant strides during the last half century, especially during the last few decades. Its expansion has been sensational, its technology has tapped every resource of chemical and engineering science, its transportation facilities have set new standards of efficiency on land and sea, its marketing activities have forged a world-wide chain of agencies and outlets, its economic well being has been served by highly expert guidance and directions, the corporate structures that have been developed by its operating companies are studied as models of modern management, its operating policies have reconciled business efficiency with human relations, and its intercourse with government—both at home and abroad—has been marked by a high standard of business statesmanship.

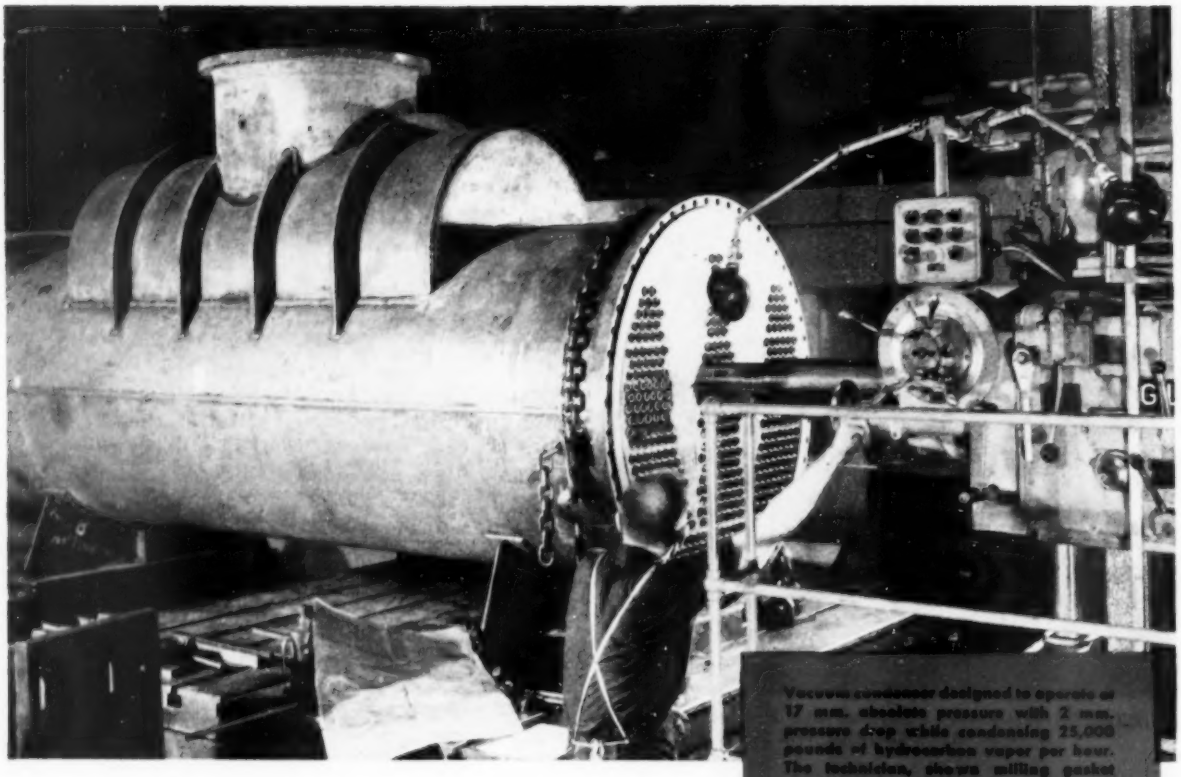
And as we now survey this complex and fast-moving industry, with which we must fall into step, we are told that it is entering upon an era of even more far-reaching development and accomplishment. If this be true, we can be sure that the place occupied by the petroleum industry in our national economy, in the technology of our times, and in the everyday lives of people the world over will insure ample opportunities for us all. That is, for all who have the courage and capacity to meet the demand for broader knowledge, higher technical competence, more efficient management and a more profound understanding of the markets and of public affairs.

To help the men of industry to cultivate those essentials is the mission of the technical and industrial press. It is an axiom of business publishing that each individual journal must become a part of the industry it serves before it can be a worthy member of the publishing industry. McGraw-Hill publishing policies and practices are based on that axiom, and each of our publications makes itself an integral part of the industry it serves. As Warren Platt has made himself, his publications, and his services a part of the petroleum industry, so we of McGraw-Hill now assume the obligation to do likewise.

To that end I pledge my own best efforts and those of my associates. We shall apply the full resources of our company to maintain a publishing service for the petroleum industry that will meet the challenge of the years ahead. For we know by experience in many other industries that a competent and responsible press, having the confidence and cooperation of its industry, promotes the kind of technical and business progress that makes for the prosperity of all.



CURTIS W. McGRAW



Vacuum condenser designed to operate at 17 mm. absolute pressure with 2 mm. pressure drop while condensing 25,000 pounds of hydrocarbon vapor per hour. The technician, shown milling gasket grooves in the tube sheet, has been with A. O. Smith continuously since 1931.

SPECIAL Heat Exchangers

FOR CUSTOMERS' PROCESS REQUIREMENTS

Shown nearing completion is the A. O. Smith solution to one of its customer's heat exchanger problems. Starting with only the process conditions, the condenser was designed and manufactured in its entirety by A. O. Smith.

Successful design of the exchanger to meet critical process requirements necessitated a special tube arrangement to provide minimum pressure drop, and inlet nozzles to give maximum distribution of vapors throughout the entire length of the condenser.

For the design and manufacture of special equipment to solve special process conditions, like the above, A.O. Smith has a corps of experienced research, engineering and manufacturing groups. For over 25 years they have been serving the petroleum and chemical industries, accumulating invaluable experience, data and skills which *YOU* may depend on to help solve *YOUR* heat exchanger and vessel problems.

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Research and Engineering Building

INDUSTRY COMES TO A. O. SMITH
WITH HEAT EXCHANGER PROBLEMS

What's Happening . . .

Refinery Expansion

. . . **Additional European avgas facilities are needed** to supply anticipated European and Eastern Hemisphere demands over the next decade. According to Deputy Petroleum Administrator Warren, total civilian and military consumption of aviation gasoline in Eastern Hemisphere will continue upward through 1957—from 53,100 b/d in '52 to 62,300 b/d in '57. At present only about 6,600 b/d of avgas is manufactured in Eastern Hemisphere, with balance being imported from Western Hemisphere (United States, Caribbean countries, Mexico and Canada). Despite prospects for increasing and continuing demands, no new avgas capacity is now known to be included in current European refinery expansion program.

. . . **A 16% increase in manufacturing capacity** is planned by the U.S. oil industry between now and 1956—7% in '53 and another 9% by '56—according to 6th annual McGraw-Hill survey of business plans for new plant and equipment.

. . . **Magnolia Petroleum Co.** has let contract for 19,000 b/d Thermofor catalytic reforming unit at its Beaumont, Texas, refinery to Lummus Co. Cost was not disclosed. Construction will start about June and unit is expected to be in operation during first half of 1954. Project was originally announced as one of several by parent company, Socony-Vacuum Oil Co. (What's Happening, Feb. '52, p. 127), to cost a total of $27 million.

. . . **Imperial Oil Ltd.** will increase capacity of its 46,000 b/d Montreal East refinery by 12,000 b/d to 58,000 b/d through installation of combination atmospheric and vacuum distillation unit and a vacuum pipe still. Catalytic cracking unit installed in 1948 will be enlarged. Improvement in product quality is principal aim of $10 million project, to be completed early in 1954; plant processes a predominantly Venezuelan crude charge.

. . . **A second Imperial Oil** project has been announced—a 250 b/d catalytic polymerization unit for the Winnipeg, Manitoba refinery. Unit will cost $750,000, with construction scheduled to be started soon.

. . . **Union Oil Co. of Calif.** has completed a $27-million modernization program at its Los Angeles refinery, increasing plant capacity from 65,000 b/d to 105,000 b/d. Processing additions include two 20,000 b/d topping units, a 38,000-40,000 b/d vacuum flasher, and 28,500 b/d Fluid catalytic cracking. A 50 ton/day ammonium sulfate plant is about to go into production.

. . . **Pan American Refining Corp.** is planning catalytic reforming facilities for its Texas City, Texas refinery, to cost approximately $8.5 million. Type of unit has not been decided upon, but target for completion is end of '54. Unit will process heavy naphtha, upgrading gasoline quality and possibly increasing refinery's output of avgas.

. . . **Sunset Oil Co.** plans to add 2,500-2,800 b/d thermal cracking unit and a 100 b/d catalytic polymerization unit to its refinery at Torrance, Calif. in a remodeling program scheduled for completion by Aug. 1. Capacity of 10,000 b/d plant will not be increased—modernization being aimed at quality improvement.

. . . **The Texas Co.** plans to construct catalytic reforming units at its Port Arthur, Texas, and Eagle Point (Westville), N. J. refineries. Company states plans are not yet far enough along to permit release of any details.

. . . **Standard Oil Co. (Ohio)** has let contract for 12,000 b/d catalytic reforming unit (Platforming) with Procon, Inc. for its Lima, Ohio, refinery. Construction is expected to start in July. Unit will be operated for product improvement, and will cost about $7,500,000.

. . . **Standard Oil Co. of Calif.,** will build a 55,000 b/d vacuum flasher at its El Segundo, Calif., refinery. Contract has been let to M. W. Kellogg Co., and unit will be a duplicate of one previously built by Kelloggg at the company's Richmond, Calif., refinery. Construction is scheduled to start by July.

. . . **New refinery expansions to look for,** as indicated by rapid tax amortizations announced last month by Office of Defense Mobilization:

D. D. Feldman Oil & Gas Co., $1,290,000 at Lake Arthur, La.

Shell Oil Co., $760,000 at Denver City, Texas.

Socony-Vacuum Oil Co., $251,500 for alkylation facilities at Paulsboro, N. J.

Sunray Oil Corp., $1,312,000 at Tulsa.

United Refining Co., $745,000 at Warren, Pa. (see Jan. '53 "What's Happening," p. 7).

Petrochemicals

. . . **Monsanto Chemical Co.** is planning to build a polyethylene plant, location for which has not been decided. Polymer has been under study at company's Dayton research laboratories and second high pressure pilot plant is expected to be in operation late in April. Present plans are to have a 66 million lb./yr. commercial plant in operation by early 1955, with a 50% increase in capacity projected for '57.

. . . **Mississippi Chemical Corp.** will increase capacity of its ammonia plant at Yazoo City, Miss. from 120 to 180 tons/day, at a cost in excess of $2 million. Girdler Corp. is prime contractor with completion expected late in '53.

. . . **Gulf Oil Corp.** is toying with the idea of building a second ethylene unit at its Pt. Arthur, Tex. plant—a companion to the unit just placed on stream. Included in the proposed expansion would be ethylene

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

oxide and ethylene glycol plants. The former would produce 40 million lbs. of oxide annually, which would in turn be converted into 5½ million gal. of glycol. The ethylene unit just put on stream is the world's largest—2½ billion cu. ft. of ethylene annually, now flowing through direct pipe line connections to Koppers, Ethyl, DuPont, Monsanto, and Allied.

. . . **Phillips Chemical Co.** has let contracts for increasing nitric acid facilities at the Cactus plant, Etter, Tex. by 50%—110 tons/day. Present ammonia and nitric acid facilities at Etter are government-owned, and leased and operated by Phillips. New facilities will be owned by Phillips, and are expected to be completed late this year. Chemical and Industrial Corp. is handling process and design, with construction being done by Chemical Processes, Inc., a subsidiary.

. . . **Shell Oil Co.** has started adding to the country's supply of aromatics—at the rate of more than 19,000,000 gal. of benzene and 33,000,000 gal. of toluene annually. A new 15,000 b/d UOP Platforming unit was put on stream at its Houston refinery last month, coupled with a recovery unit utilizing Shell's extractive distillation process. Feed stock is light naphtha from East Texas and West Texas crudes.

. . . **Dow Chemical Co.** will build a polyethylene plant at its Freeport, Texas, plant, to be operating in 18 to 24 months. Process will be licensed from Imperial Chemical Industries of Great Britain.

. . . **Deep Rock Oil Corp.** is planning to build an aromatics plant at its Cushing, Okla., refinery, according to its annual report, and states negotiations are under way for development, manufacture and sale of "some interesting new petrochemicals."

. . . **Phillips Chemical Co.** has requested approval of Texas Railroad Commission to store ammonia underground, first proposal of its kind in the state. Company proposes to wash out caverns from salt formations 1500 to 2500 ft. deep in Moore County, near the Cactus plant it leases from government.

. . . **New petrochemical projects in the wind,** as indicated by rapid tax amortization approvals granted last month by Office of Defense Mobilization:

Allied Chemical & Dye Corp., $550,000 for facilities at Baton Rouge, La. to produce "monomer for plastics used by military services."

Esso Standard Oil Co., $2,994,722 for methyl ethyl ketone facilities at Bayway, N. J.

Shell Chemical Corp., $9,000,000 for synthetic glycerine at Houston, $297,000 for acetone at Houston, $6,900,000 for isopropyl alcohol (for acetone) at Norco, La., and $400,000 for methyl isobutyl ketone at Dominquez, Calif.

Markets, Prices

. . . **Price declines for a wide list** of refined products were evident during March, the first full month since decontrol of petroleum prices by Office of Price Stabilization. Some declines were sharp.

Product price increases in primary supply markets that have "stuck" thus far were all west of the Rocky Mountains, where California crude postings were boosted immediately following decontrol (see "What's Happening" for March, p. 304). Elsewhere the price trend was downward, reflecting an abundant inventory position of most items.

An increase in wholesale gasoline prices made by Socony-Vacuum Oil Co. throughout New York state and New England averaging 0.5c a gal. late in February failed to hold. Several principal marketers in the area failed to go along with the boost, with result that Socony backed down to meet the competition.

. . . **Highlights of price declines follow:**

Gasoline—Gulf Coast 83 oct. regular-grade down 0.25c to 10.5c a gal.; New York harbor regular down 0.5c to 12c.

Distillates—Oklahoma kerosine off 0.25c to 8.375c; Chicago District range oil down 0.525c to 10.375c, No. 2 fuel 0.4c to 9.5c.

Heavy Fuels—Oklahoma No. 6 off 5c to $0.85 a bbl.; Chicago No. 6 down 0.5c to 5.2c a gal.

Lubes—Gulf Coast solvent bright stock down 1.75c to 21.5c a gal.; 200 vis. solvent neutral down 1c to 14c; Mid-Continent solvent bright down 1c to 23c; Pennsylvania bright down 1c to 24c; Pennsylvania cylinder stocks down as much as 3c, with 600 steam refined at 19c.

Industrial Mobilization

. . . **Domestic civilian demand for alkylate** will increase sharply during next ten years, according to recent PAD study of future aviation gasoline needs. Consumption of avgas by civilian aircraft is expected to increase more than 30% by '55, and more than 60% by '62 over 1952 levels. Greatest increase, however, is expected in grades above 100/130, which require nearly half again as much alkylate per gallon as grade 100/130. Demand for grades above 100/130 will jump more than 400% over '52 demand. PAD estimates, detailed below, do not include military demand, and assume continuance of present economic conditions and no all-out war.

PROJECTED U.S. CIVILIAN AVGAS DEMANDS

(Thousands of barrels annually)

Year	Under 100 Octane	100/130 Octane	Over 100/130 Octane	Total
1952	3,805	15,282	2,287	21,374
1953	3,525	17,410	3,265	24,200
1954	3,245	17,955	5,335	26,535
1955	3,120	18,100	6,960	28,180
1956	3,025	18,250	7,750	29,025
1957	3,040	18,515	8,300	28,855
1962	3,060	19,420	12,050	34,530

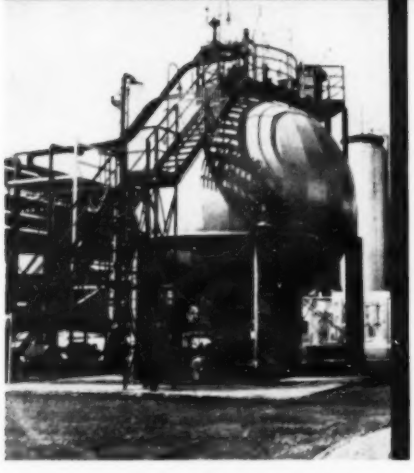
. . . **A new plan for alkylate plant financing** has been worked out by Armed Services Petroleum Purchasing Agency, under which ASPPA is permitted to use part of special $82 million government fund to make loans for construction of needed alkylate facilities. New plan is being offered as an alternate to former plan under which fund was used only to guarantee government's promise to purchase certain minimum output of alkylate facilities or to pay for standby maintenance. Under new plan fund can be used to finance building of plant. Refinery would retain title to plant, but its operation would be subject to government direction.

24 REFINERS INCREASE DAILY THROUGHPUT WITH PETRECO DESALTING

In one refinery after another, Petreco desalting has promoted operational savings. The resulting fast "pay outs" have rendered the cost of the desalting installation virtually incidental. These fast pay outs result from one basic factor – *Petreco desalting enables the refinery to run more crude.*

The table below shows typical results of Petreco desalting in twenty-four refineries recently surveyed. These refineries charge a wide variety of crudes. Note the barrels of crude run per day – before, and after, desalting. Note the number of days on stream – before, and after, desalting. Note the percent increase in throughput. Why not have these benefits in your refinery? They easily pay for the cost of desalting, and result in substantially more profitable operations.

No.	TYPE OF CRUDE	GRAV. °API	BBLS. PER CAL. DAY		% INCREASE	NO. OF DAYS ON STREAM	
			BEFORE DESALTING	AFTER DESALTING		BEFORE DESALTING	AFTER DESALTING
1	OKLA. ASPHALT	16	950	1,900	100.0	1	75
2	TALCO, WINNSBORO	21	10,500	14,000	33.0	14	360
3	STEPHENS, ARK.	29	1,200	2,000	66.6	10	90
4	SO. LA. SWEET	38	11,000	13,000	18.2	100	125
5	NO. TEXAS SWEET	37	6,760	7,540	11.5	26	78
6	KANSAS SWEET	30+	3,360	3,820	13.7	37	125
7	MICHIGAN LIGHT	44	3,000	4,000	33.3	18	180
8	MIXED CRUDES	16-38	13,000	17,000	30.8	90	180
9	NO. TEXAS-OKLA.	40	8,000	10,000	25.0	33	145
10	GULF COAST	33	15,000	17,500	16.7		
11	WEST TEXAS, SOUR	32	3,900	4,900	25.5	30	180
12	OKLAHOMA, SOUR	20	1,960	2,840	45.0	30	90
13	SHULER, ARK.	33	15,800	18,000	14.0	7	150
14	NEW MEXICO, SOUR	35	1,350	2,150	59.0		
15	WEST TEXAS, SOUR	34	1,000	2,500	150.0	10	40
16	MICHIGAN	38	2,800	3,500	25.0	2	60
17	HASTINGS, SO. TEXAS	31	31,102	41,184	32.4	29	65
18	NO. TEXAS, OKLA.	40	4,000	4,940	23.5	90	180
19	MID CONTINENT	37	4,450	4,950	11.2	45	225
20	RANGER, NO. TEXAS	41	6,000	8,000	33.3		
21	WEST BRANCH, MICH.	33	1,500	3,000	100.0	4	30
22	MICHIGAN	37	14,300	22,100	54.5		
23	SANTA MARIA	14	2,200	2,700	22.7	60	365
24	WEST TEXAS, SOUR	33	1,850	2,750	48.5	90	366



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(To obtain more data on advertised products see page 600)

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Contact towers and settling tank at East St. Louis refinery of Socony-Vacuum Oil Co.

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Secondary Waste Treating Methods Grow, Although Costs Remain High

A NUMBER of trends are becoming apparent in the treatment of refinery wastes, according to R. N. Giles, of Indiana Standard, speaking at the annual meeting of the Western Petroleum Refiners Ass'n. last month.(1)

Recently, several refiners have begun water-conservation programs, he said. The potentialities are illustrated by one northern refinery, which reduced its effluent from about 144 to 7 million gals./day, primarily through the installation of cooling towers. The program entailed much expense and had its drawbacks, but pollution was considerably reduced. This approach to the problem is a fundamental one that will undoubtedly be used more in the future, Giles stated.

Refinery managements have been progressive in incorporating such advances into their waste-treatment programs, particularly in new refineries, and have markedly upgraded the quality of their effluents. However, some refiners have begun to seek still better methods.

Two techniques appear to have good possibilities —chemical flocculation and the use of biological trickling filters. Chemical flocculation performs better on suspended impurities and therefore removes more oil, turbidity, and suspended matter. Trickling filters operate more effectively on dissolved solids, and thus give higher removal of biochemical oxygen demand, chemical oxygen demand, and phenol.

Chief problem so far is tremendous costs on the so-called secondary methods of treatment. An oil-water separator for primary waste treatment costs about $27,000 per million gals. of water treated per day. Secondary treatment—by either of the above methods—costs over five times as much, around $150,000/million gals./day. And it still leaves faint residual tastes and odors. —W. C. U.

(1) "Technical and Political Trends Affecting the Disposal of Refinery Wastes," R. N. Giles, Standard Oil Co. (Indiana); presented at the 41st annual meeting, WPRA, San Antonio, Texas, March 23-25, 1953.

Petrochemicals Seen as an Industry With Good Future in Great Britain

BRITISH authorities see a bright future for the petrochemical industry in that country. Several plants and processes were described during a Symposium on Petroleum Chemicals in the United Kingdom recently in London.(1)

Among processes expected to assume positions of industrial importance are: 1) the direct oxidation technique for producing ethylene oxide, replacing the traditional chlorohydrin route; 2) the direct oxidation of propylene (although not as yet commercially feasible); 3) the OXO reaction for producing aldehydes and higher alcohols; 4) the cumene route for phenol; and 5) the Ziegler reaction, in which aluminum trialkyls serve as catalysts for the polymerization and dimerization of olefins, which would be used to prepare valuable straight-chain waxes.

Detailed economic studies by Petrochemicals Ltd. of a hypothetical plant favored the direct oxidation of ethylene over the chlorohydrin technique. Assuming a price of $70/ton for chlorine, an 8000 ton/yr. production of the oxide, and all feasible prices and efficiencies for ethylene; a greater annual profit can be realized from direct oxidation than from the older and well-tried chlorohydrin process, even with higher capital cost for plant.

Acetone as a by-product contributes to the economics of the cumene process for producing phenol from benzene, according to Distillers Co. Ltd. About 0.6 lb. acetone is produced per lb. of phenol. When a reasonable value is taken, the cost of producing the phenol is 70-80% of that by any one of three other possible routes. It was also stated that capital investment is 80-90% of the older methods.

Synthetic ethyl alcohol by the direct catalytic hydration process has been under way for some 18 months now in an installation at Grangemouth, Scotland, operated by British Petroleum Chemicals Ltd., a company formed jointly by Anglo-Iranian Oil Co. and Distillers Co. Ltd. It was inferred that synthetic alcohol could be produced for 7 to 8c/gal. less than fermentation alcohol from Cuban molasses.

A gradual elimination of the demand for heavy inorganic chemicals will develop in Britain, according to the closing address speaker at the symposium. He visualized and urged an extension of "blind" research on catalysis, and said that as many catalytic processes as possible must be industrialized. —W. C. U.

(1) "British Assess Petroleum Chemicals Potentials; Urge More Expansion," anon., *Chem. & Engrg. News*, March 16, 1953, pp. 1084-6; a report on a symposium held jointly by the Society of Chemical Industry and the Institute of Petroleum.

Extending Our Knowledge Of Motor Fuel Behavior

THE 14th annual report on the API Research Project 45, just presented,(1) reviews the work being carried on at Ohio State University Research Foundation in the synthesis, purification and properties of hydrocarbons within the gasoline boiling range. An added feature of the work of this project, since it was originally laid out, is the evaluation of the knocking characteristics in spark-ignited engines of many of the hydrocarbons synthesized in the studies at Ohio State. Portions of the products made there are sent to the research laboratories of General Motors Corp. and of Ethyl Corp. for engine evaluation.

"Knowledge of the knock-limited engine performance of pure hydrocarbons and their response to tetraethyl lead has been further advanced this past year by the ratings of 23 compounds", it is reported. "These compounds consist of six naphthenes, 11 unsaturates, four aromatics and two cyclic ketones. Out of the engine evaluation of these hydrocarbons has come confirmation of various relationships between molecular structure and engine behavior."

For the coming year, research on hydrocarbons in the project is being concentrated on olefins and cyclic unsaturates and will include a few cycloparaffins. With regard to the engine study group, consideration

is being given to a systematic study of the blending characteristics of pure hydrocarbons.

The current work of Project 45 is not all in the direction of adding to the already extensive data on the combustion characteristics and knock ratings of hydrocarbons—321 compounds have been tested to date. Contributions have also been made to the knowledge of synthesizing hydrocarbons. Synthesis techniques developed the past year include, among others, extension of a method for converting olefins into acetylenes, the alkylation and rearrangement of allylbenzenes, and methods for the synthesis of rare hydrocarbons once considered incapable of existence. In many ways the work of the project represents advances in hydrocarbon chemistry, the practical value of which will not be known until long in the future, when applied research learns how to make use of the accumulating basic data.

Project 45, as with others of the API project, continues to serve its incidental purpose of training men in the field of hydrocarbon chemistry. Over its 14 years, Project 45 has provided employment for 52 men who have worked for advanced degrees in chemistry at Ohio State. Over a third of these men are now engaged in the petroleum industry and almost another third are with chemical and pharmaceutical companies. Their future achievements may further enhance the value of API Research Projects to the petroleum and allied industries. —V.B.G.

(1) Fourteenth Annual Report, API Research Project 45: "The Synthesis, Purification and Properties of Hydrocarbons of Low Molecular Weight;" Assembled and Distributed by Ohio State University Research Foundation, Columbus, Ohio.

Good Source of New Capital Seen In Worker Stock Purchase Plans

ALTHOUGH there is as yet no rush to get on the "employe stock purchasing plan" bandwagon in the petroleum and chemical industry, those companies which have adopted such programs are very enthusiastic. So much so that investment brokerage firms are showing increased interest.

Louis Stone, chief statistician for Hornblower & Weeks, who has made a comprehensive study, said recently that "It seems inevitable that the trend in other industries soon will lead chemical companies to try it for themselves."(1)

Concerns using such plans praise them for: 1) giving each employe a direct and continuing incentive to help keep production high and operating losses low, 2) providing a fair and automatic method of profit sharing, and 3) bringing about a closer corporation family set-up, without the traditional split between employes and stockholders.

Investment authorities point out that as wages have gone above the level of bare living costs, capital has been formed at the grass roots level on a scale that has left the country's investment mechanism far behind.

Not to be left behind, of course, are those firms already operating stock plans of one type or another: for example, Phillips Petroleum, Indiana Standard, California Standard, Dow Chemical, du Pont, Monsanto, Union Carbide, American Cyanamid, Hercules Powder, Penn Salt, Commercial Solvents, Mathieson, etc.

With some 750,000 hourly workers in the chemical industry receiving an average of around $70/week, it is no wonder the investment experts are interested. As Stone emphasized, "The accumulation of workers' funds over and above living needs is a fact, not a theory: unless management provides investment facilities, and does it right, somebody else will surely come along and possibly do it wrong." —W.C.U.

(1) "Solid Incentives, Cozy Ties," *Chemical Week*, January 10, 1953, pp. 12-13.

Underground Storage May Solve Problem of Defense Oil Needs

THREE new angles have arisen in recent years to complicate the oil industry's already-complex storage problem.

The first is the military need for stockpiling so that emergency needs for petroleum products (either far in excess of immediate plant capacity or at a remote location) can be met almost instantly. The second, also of military import, is to put that storage where it cannot be readily damaged in event of attack or by sabotage. The third is that perennial duet—money and materials.

The best answer, although by no means a panacea for storage troubles, is to go underground. And, according to Max and Douglas Ball, oil and gas consultants, the industry trend is toward more underground storage. The Balls discussed such storage methods during the recent meeting in San Antonio of the Western Petroleum Refiners Assn.(1)

One method they described is relatively new and as yet unused in the U.S. It is known as the "Edholm container"—which may be either an excavated or natural underground cavern with the permeable parts of roof and walls below the water table. It relies on presence and pressure of ground-water to prevent loss of the stored material, therefore the level of the stored material must be enough below ground-water table so that this pressure always will exceed the product vapor pressure. For non-volatiles like fuel oils and some crudes, the container theoretically need not be roofed except to keep out debris or for safety reasons.

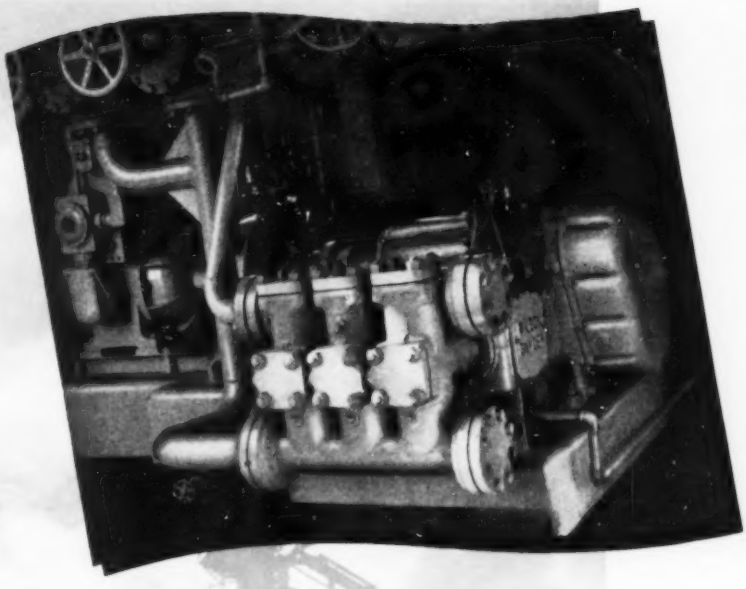
The Edholm method has been used four years in Sweden (residual fuel) in an underground cavern, at an investment of "considerably below $1 per bbl". If the cavern must be mined the costs may go to $10 per bbl. for small storages and such products as propane. For volumes in the million bbl. class the cost may drop to $1-$2 per bbl.

Edholm storage is feasible, the Balls believe, in unconsolidated sediments abounding on the Atlantic and Gulf Coasts as well as in washed-out or mined caverns. In general, Edholm container costs will be favorably below high-pressure above-ground steel storage but may exceed low-pressure above-ground steel storage erection costs. No problems of emulsification have been encountered.

This and other such methods may prove a particular boon to the oil industry in meeting the desires of the Armed Services Petroleum Purchasing Agency. Last February that agency told the National Petroleum Council that "several million barrels of additional storage" are needed so ASPPA can take deliveries from refiners as produced. —D.P.T.

(1) "Underground Storage of Liquid Petroleum Products," Max and Douglas Ball, Oil & Gas Consultants, Washington, D. C., presented at the 41st annual meeting, WPRA, San Antonio, Texas, March 23-25, 1953.

"This Wilson-Snyder Triplex Pump



is performing so well in Reactor Charge Service for our Platforming Unit at Grandfield, Oklahoma,

that we're using TWO MORE

—in our Ben Franklin Refinery at Ardmore!"

— says Dr. I. Arthur Anson
Vice President in Charge of Refining
Bell Oil and Gas Company

—in Bell's Grandfield Refinery

. . . a Wilson-Snyder Triplex plunger pump, size 3¾" x 6", is the reactor charge pump for the U.O.P. designed platforming unit which went on stream in June, 1951.

This pump is equipped with hardened steel plungers (500 Brinell) and heat-treated and hardened drop-forged stainless steel valve service. It utilizes the output of a 50-hp. electric motor, through a gear reducer, to develop differential pressures of 800 to 900 p.s.i. through 4" intake and 3" discharge piping; handling hydrocarbons having a specific gravity of 0.67 at pumping temperatures of 275°F.

—in the Ben Franklin Refinery at Ardmore

. . . two more Wilson-Snyder pumps of the same size and type will be used in the new "cat" unit. One of these pumps will serve as the fresh feed pump—the other as a recycle and quench pump.

Bell Refinery, Grandfield, Oklahoma

When You have pumping applications that demand reliable performance, contact "Oilwell's" nearest Refinery Specialist at Area office points shown below and get complete information on . . . WILSON-SNYDER REFINERY PUMPS.

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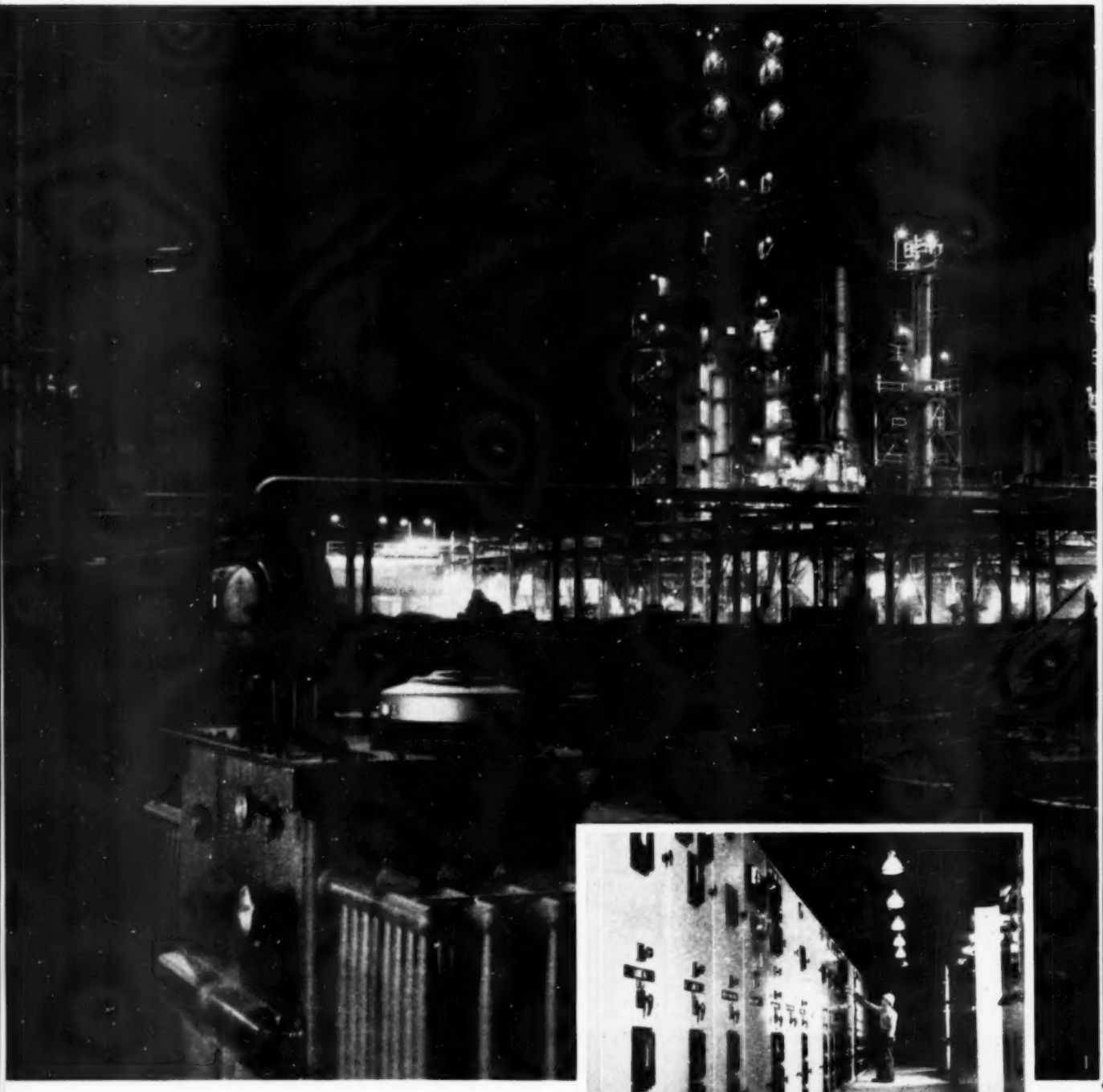
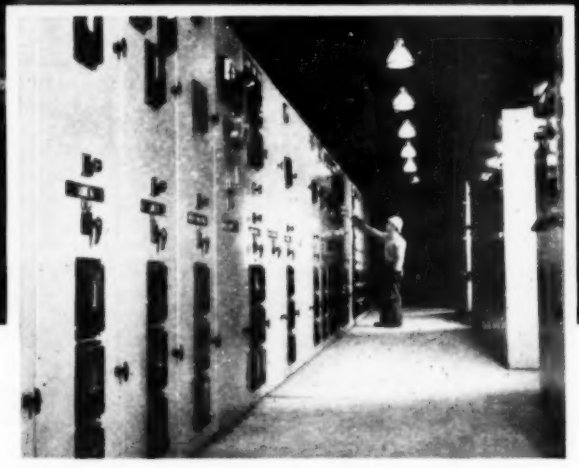
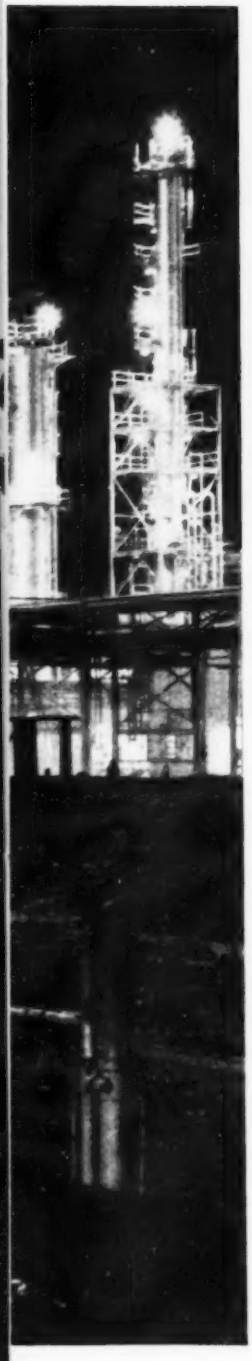




How to get high power dependability without paying for standby capacity



When Sohio modernized and expanded the Lima refinery they needed a highly dependable power system. But they didn't want to pay for emergency stand-by capacity, a common way to achieve reliability. So engineers from Sohio, Dingle-Clark Co., and Westinghouse worked out an ingenious solution based on a sound basic principle.

Ingenious Controls Instead of Transformers

The basic principle is this: that you don't need *absolutely continuous power* for high reliability, but rather *speedy restoration of service* after disturbances do occur. So instead of providing for expensive extra transformer capacity, they developed a control system that automatically and rapidly clears trouble. And a power loss up to four seconds doesn't slow down the plant.

Devastating Tornado Didn't Stop Operation

The results of this sound planning were soon evident. Nine months after installation, a devastating tornado hit Lima and knocked out one of the two power lines serving the plant. The two key motors (catalytic cracker blower drive) were thrown out of synchronization. But both were immediately restarted by the ingenious control system. Then a second fault knocked them out again and one motor restarted to keep the process going all through the disturbances.

Disturbances are Cleared Automatically

In the first nine months of operation, there were 12 disturbances which affected these key blower motors. On ten occasions, the controls automatically restarted the motors. The other two times, the motors were restarted manually. Numerous other disturbances have failed to affect plant operation in *any* way.

Call Westinghouse Early On Your Next Project

The key to continuous power is good planning. Westinghouse would like to do this kind of planning with you. Call us in *early* when *you* build, expand or modernize. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Penna.

HOW SOHIO GOT HIGH RELIABILITY AT LOW COST

To keep the costs down, they built very little spare capacity into the system. Thus if there is a momentary outage, the load must be reapplied in segments. The operation is controlled by Westinghouse high-voltage switchgear, shown at left.

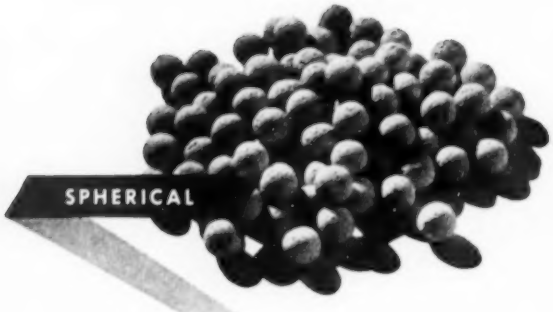
The big power users are the blower motors. If power outage occurs, they're automatically taken off the line by a clever "under-frequency" relay so that the rest of the plant can start up when the fault is cleared. Then in less than one minute, one of the blower motors restarts automatically. The plant keeps operating through the disturbance.

J-94906

YOU CAN BE SURE...IF IT'S

Westinghouse

EQUIPMENT FOR THE PETROLEUM INDUSTRY



Preformed Catalysts made to order

HARSHAW

PREFORMED CATALYSTS to Fit Special Process Requirements for

Hydroforming
Cyclization
Oxidation
Dehydrogenation
Dehydration
Desulphurization
Alkylation
Isomerization
Hydrogenation

TYPICAL CATALYSTS

Aluminum Chloride Anhydrous
Boron Fluoride Addition Compounds
Boron Trifluoride
Hydrofluoric Acid Anhydrous

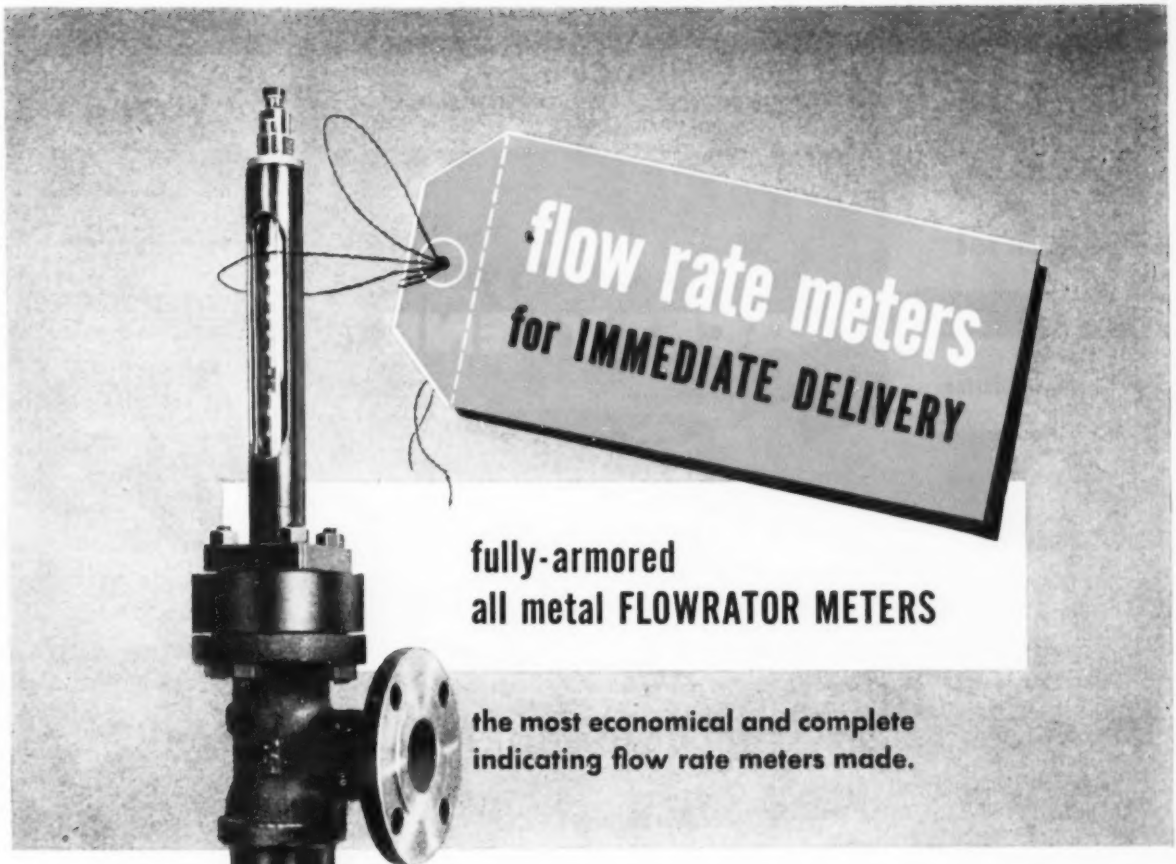
Alumina
Chrome Alumina
Molybdena Alumina
Tungsten Alumina
Cobalt
Copper
Magnesia
Nickel
Vanadium

MORE THAN 15 YEARS AGO

In 1938, Harshaw first began the manufacture of catalysts to customers' specifications. From a few catalysts for a few processes in 1938, Harshaw has continuously magnified its efforts until at the present time we manufacture, to specification, dozens of catalysts for many different important manufacturing processes. We have solved many individual catalyst problems, and are ready to apply our depth of experience and large production facilities to any catalyst development problem which may be presented to us.

THE HARSHAW CHEMICAL CO.
CLEVELAND 6, OHIO

CHICAGO • CINCINNATI • DETROIT • HOUSTON • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH



fully-armored all metal FLOWRATOR METERS

the most economical and complete indicating flow rate meters made.

With Indicator Extension

With Pneumatic Transmitter

Delivery right from Fischer & Porter stock in Chicago, Dallas, Los Angeles and Hatboro means much to you.

Now you can have the wide range, linear scale Fig. 52 all-metal meter quickly, in 150-lb. and 300-lb. ratings in steel or 316 stainless. These meters are complete meters and not just metering elements, are low in price and may be equipped with Magnabond pneumatic transmitters or all-metal magnetic indicators which are regularly stocked.

Six sizes in FLOWRATOR Meters will cover a capacity range from a fraction of a GPM (or SCFM) to 240 GPM (or 850 SCFM). Each meter, with Stablvis float, has a viscosity immunity well above that found in orifice practice. Write for complete information including Variable Area Handbook.

5 distinct features

- One moving part, no stuffing box
- Wide rangeability
- Viscosity immunity
- Linear calibration
- Safe, all-metal construction

FISCHER & PORTER CO.

1140 County Line Road, Hatboro, Penn.

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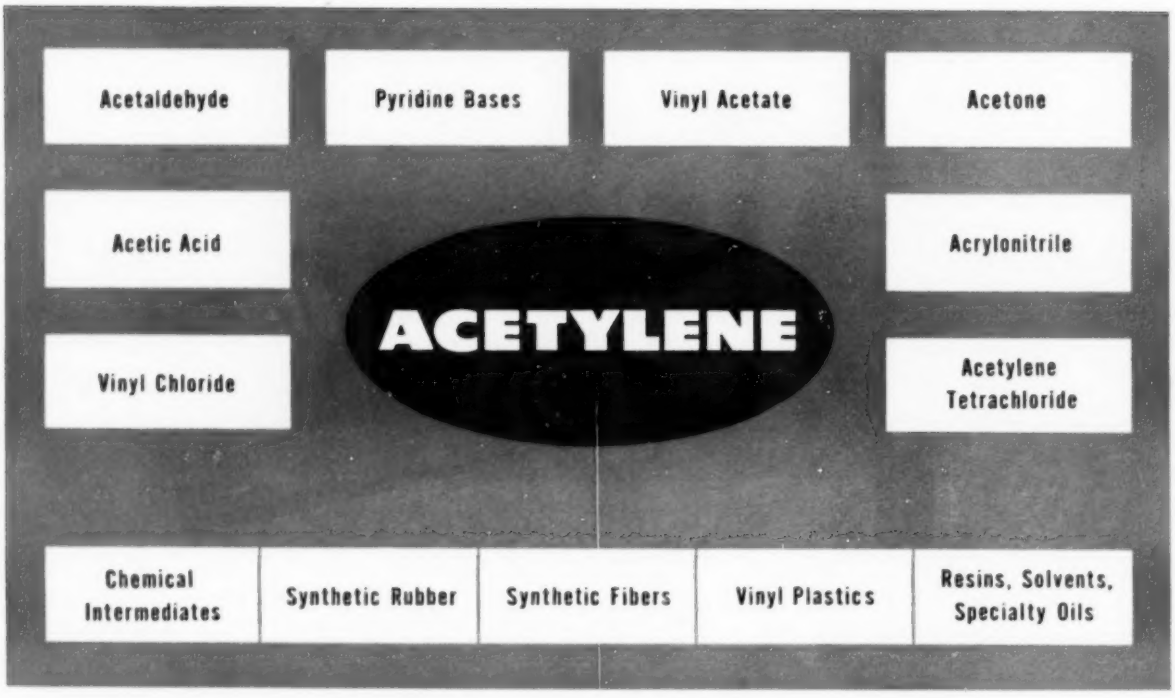

Low-cost acetylene . . . for high-demand products

Acetylene is fast pushing into the limelight as a base material for making organic chemicals. In stride with this activity, Lummus makes available the Wulff Process for the production of high-purity low-cost acetylene from light hydrocarbons.

There is much to recommend a plant utilizing the Wulff Process:

- ***Acetylene manufacturing costs of about 6½ cents a pound are indicated.***
- ***No oxygen plant is required; electric power costs are modest.***
- ***Low maintenance costs have been proved.***
- ***Process flexibility permits continuous operation on a variety of feed stocks, in units within a broad capacity range.***

Lummus is prepared to design, engineer and build a Wulff Process plant to fit your acetylene scheme. We'd be pleased to team up with you.

Want More Information?

Lummus has developed valuable technical and economic studies of acetylene production by the Wulff Process. These data are bound into a 24-page report, a copy of which is yours for the writing, without obligation. Just drop us a line at Room 359, 385 Madison Avenue, New York 17.

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

HOUSTON • CHICAGO • LONDON • PARIS • CARACAS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

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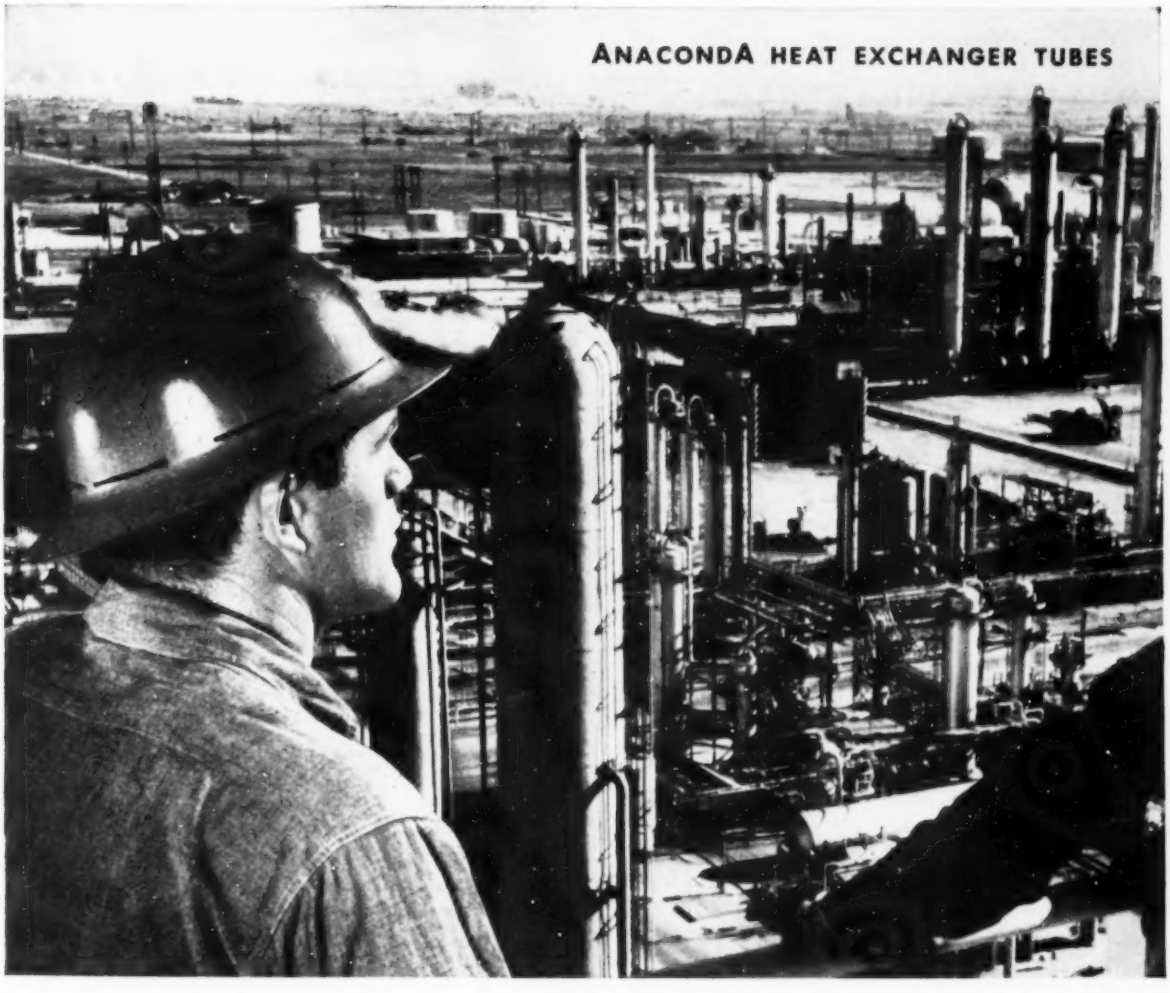

CUPRO NICKEL, 30%-702

for your toughest heat exchange problems

CUPRO NICKEL, 30%-702, is the best and most widely used copper alloy for tubes in refinery heat exchangers operating under the severest conditions—where corrosive materials and cooling waters must be handled at relatively high temperatures and pressures.

In refinery heat exchanger equipment, tubes of Cupro Nickel, 30%-702, retain strength at relatively high operating temperatures and are resistant to stress-corrosion cracking. The alloy has the property of forming protective films of corrosion products, making it particularly desirable for service where sea water, even at relatively high velocities, is used for cooling.

Our Technical Department will welcome the opportunity to investigate your heat exchanger tube problem and to draw upon its long experience in tube performance to suggest the most suitable alloy. Feel free to use this service. Use the coupon below for your copy of Publication B-2, "ANACONDA Tubes and Plates for Condenser and Heat Exchangers."

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ANACONDA®

HEAT EXCHANGER TUBES

The American Brass Company, Waterbury 20, Conn.
(In Canada: Anaconda American Brass Ltd., New Toronto, Ontario)

Send me Publication B-2 "AnacondA Tubes and Plates for Condensers and Heat Exchangers"

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COMPANY

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CITY ZONE STATE

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FOR REAL HELP TO SMALL BUSINESS

It is ironic that one of the first jobs of the Eisenhower administration, so widely, and erroneously, tagged as a "big business" administration, must be to go to the relief of small business. This is necessary because the preceding administration, while continually proclaiming its tender regard for small business, actually impaired gravely the ability of small business to carry on successfully. This it did in the necessary haste of devising an emergency tax program to finance rearmament and the Korean War. Now the new administration must revise this tax structure to give small business a chance to make its key contribution to an expanding American economy.

How Taxes Hurt Small Business

Since the outbreak of the Korean War, small business has been handicapped by two principal features of the emergency tax program:

1) Many small firms are unable to retain enough of their earnings to provide for expansion because these earnings are drastically limited by the excess profits tax.

2) Small companies have received a very small share of the tax concessions allowed by the federal government to encourage construction of defense facilities.

A small business that succeeds and hence grows is particularly hard hit by the excess profits tax. That tax, of course, applies to corporations having a net income of more than $25,000 per year. It results in taking up to 82 cents on every dollar of profit that the company earns above what is called an "excess profits credit." For most small companies the credit depends on what was earned in 1946-49. This creates an element of gamble and discrimination in determining the amount of tax to be paid. Time has proved that it is impossible to select a base period for the tax that is fair to all companies. A young company starting in 1946-49 is peculiarly vulnerable, as its earnings in that period were necessarily low. Even on modest earnings today, it would pay a high excess profits tax.

It is true that Congress wrote into the excess profits tax law provisions to lessen the impact of the tax on growing companies. However, none of these provisions in practice has given much relief to small business.

"Relief" Provisions Give Little Relief

Small firms rely almost entirely on retained earnings to provide funds for improving their plants and equipment. They get very little help from the provisions (1) that no more than 70 per cent of total profits can be taxed away, (2) that additional earnings are allowed on an increase of invested capital or (3) that growing companies are allowed a

rate of return on capital equal to the industry average.

Most large firms can obtain additional funds in the securities market. But small firms find it difficult to increase their capital by selling securities, since investors generally prefer the stocks or bonds of nationally known and seasoned companies. Few small companies, therefore, can reduce their tax burdens by increasing their invested capital, and few can meet their needs for equity capital if their rates of profit are no higher than those of the leading companies which generally set the average profit.

Small business has been equally at a disadvantage in the matter of accelerated depreciation for tax purposes. The government has encouraged a great expansion of our industrial plant, despite the very high rate of taxation on corporate earnings, by granting certificates of accelerated amortization on new plants built to support the defense program. These certificates allow business to charge off the cost of defense plants at a rapid rate. This decreases the earnings that are subject to taxes, and so increases the part of the earnings that may be retained in the business.

Growth is Stifled

But most of these tax concessions have been made to large firms especially equipped to handle the complex problems of defense production. Of the $12 billion of new facilities so far approved for fast amortization, only 11 per cent are for companies with less than 500 employees, although the share of such companies in the normal civilian business is about 30 per cent. In only 2 of 12 industries studied by the Small Defense Plants Administration were small firms receiving what was estimated to be a fair share of the total tax amortization awarded.

Because they are unable either to retain enough earnings after taxes or to step up their depreciation allowances, most small firms are unable to keep up in the race to expand and modernize plant capacity. The Small Defense Plants Administrator, in his report to Congress, emphasized that small companies have been unable to do their full part in the defense program for lack of capital.

The Council of State Chambers of Commerce recently published an eight-state survey showing widespread cutbacks of plans for new plants by small and medium-sized companies. According to this report, "high federal taxes enacted since the beginning of the Korean War appear to be placing an effective brake on the rate of industrial expansion in all the states surveyed and probably in the 48 states generally . . . It is principally the small and medium-sized companies whose growth is being stifled."

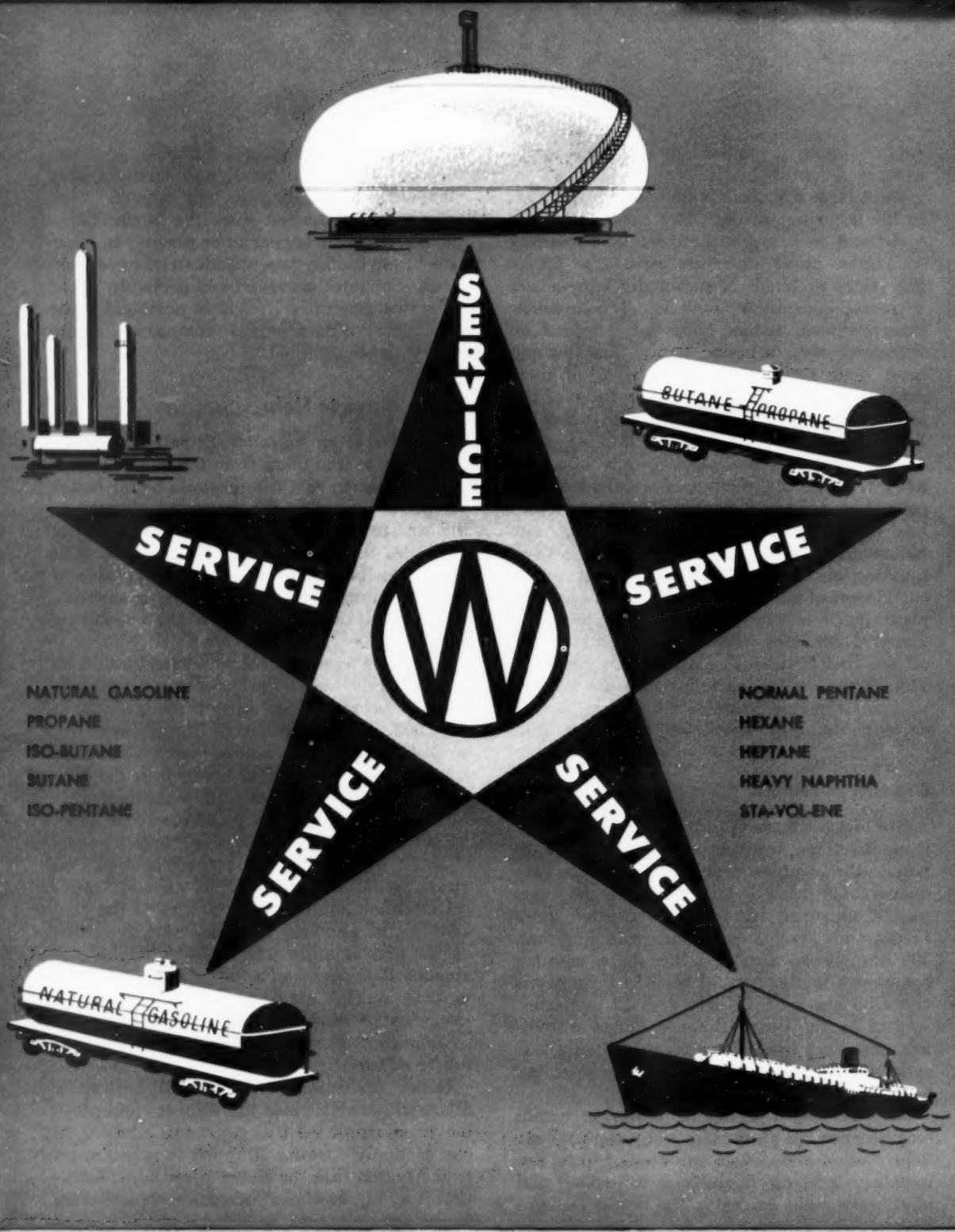
Some Ways to Help

The first step to relieve small companies should be to free them from the excess profits tax. The nation as a whole would be far better off if the excess profits tax were allowed to die as scheduled on June 30, since the tax promotes waste as it stifles incentives. It is quite possible, however, that the politics of tax reduction, as opposed to the economics, will prevent the elimination of the tax during 1953.

If the tax is extended, provision should be made for a much broader exemption to smaller corporations. If net income up to $100,000 a year, which in these days still constitutes small business, were exempted from the tax, the loss of revenue to the government would be about $175 million. This relatively small amount could easily be offset by an increase in employment and incomes if small business is freed from its financial strait jacket and allowed to expand. Careful attention should be given also to the possibilities of allowing a higher rate of return on the first $1 million of capital (roughly the amount it takes to provide 100 jobs) and of making special accelerated depreciation allowances to smaller firms. This is a matter so important that we shall return to it in a future editorial.

Relief for small business—relief from a financial paralysis that has kept it from playing its dynamic part as a growth element in our economy—would do much to give the lie to the notion that the Eisenhower administration is a "big business" operation. Much more important, it would be a long stride toward releasing the dynamic energies of many small businesses and businessmen to forward a continuing and expanding prosperity.

McGraw-Hill Publishing Company, Inc.



WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA CABLE ADDRESSES: Stavolene, Warren

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS

FOR SEVERE THROTTLING AND FLOW CONTROL SERVICES . . .

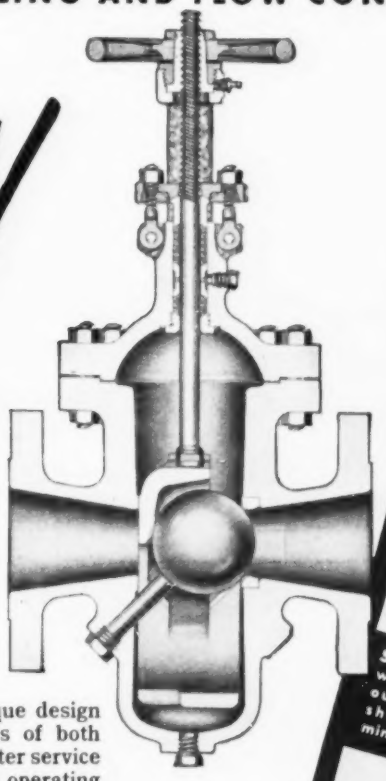
NEW

CRANE-PAUL
Venturi-Ball
VALVES

(Patented and Patents Pending)

CAST STEEL OR CRANE 18-8Mo ALLOY

Outside Screw and Yoke—Flanged. Available with sliding stem for assembly with power operators.



Fully closed with ball disc locked in outlet port. Ball seldom seats in same position, thus minimizing wear and erosion.
Smooth opening begins when ball cage "rolls" ball out of its seat. Crescent shape opening permits minute throttling.
Inclined surfaces in the cage lift the ball disc clear of the seating surface.
Fully opened with U-shaped bottom of cage bridging the gap in body to form a continuous flow passage.

Meet the Crane-Paul Valve—a unique design that combines desirable advantages of both gate and globe valves. It provides better service and longer life under more rigorous operating conditions than such valves normally stand. These features include—

Exceptionally accurate throttling with a minimum of wear and erosion, resulting in long-lived seating surfaces.

Straight-through, non-turbulent flow—with pressure drop characteristics approaching those of venturi-type gate valves.

Smooth, easy response throughout the entire range of operation.

Completely tight shut-off.

Heart of this new Crane-Paul Valve is a precision-ground ball disc which rides loosely in a cage direct-connected to the valve stem. In operation, the ball is moved to and from the center of flow and rolls into and out of the body seat. At no time during valve operation does the ball spin or chatter, even in closely throttled positions. It revolves just enough to provide a new seating surface each cycle. In the closed position, part of the ball actually protrudes into the outlet port where it is tightly seated by the wedging action of the ball cage.

Literature Sent on Request

Full information on this new Crane-Paul Valve is in your Crane 53 Catalog. Literature is available from your Crane Representative or on request to address below.

Cast Steel
150-Pound, Sizes 1 through 6"
300-Pound, Sizes 1 through 8"
600-Pound, Sizes 1 through 4"

Crane 18-8Mo Alloy
150-Pound, Sizes 1 through 6"
300-Pound, Sizes 1 through 8"

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

"WHERE DO YOU GET YOUR ALKALIES, JIM?

"I ALWAYS GO TO SOLVAY *FIRST* FOR ALKALIES··*Here's why...*

SOLVAY

Soda Ash
Caustic Soda
Caustic Potash
Chlorine
Potassium Carbonate
Calcium Chloride
Sodium Bicarbonate
Specialty Cleansers
Sodium Nitrite
Monochlorobenzene
Para-dichlorobenzene
Ortho-dichlorobenzene
Ammonium Bicarbonate
Ammonium Chloride
Sesquicarbonate of Soda

... **First off, I've found** that Solvay always takes care of its customers—in good times and bad! I know I can really depend on Solvay in a pinch.

I also like the treatment I get from the sales staff—always courteous and helpful. And it's convenient doing business with Solvay because one of their sales offices is located near me.

In addition, I feel that when I buy alkalies, I might as well get the "extras" that Solvay offers ...like the Solvay Technical Bulletins that give you the kind of information no other technical bulletins have. Same with the Solvay Technical Service staff, a group that operates on an industry-wise basis, with men who are experts in individual industries.

Then Solvay has over 200 local stock points that practically cover the country, and three centrally located plants. This makes for better delivery service.

And, of course, I know I get dependable quality and uniformity when I order from America's oldest and largest producer. That's why I always go to *Solvay first* for alkalies.

SOLVAY PROCESS DIVISION
Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.

BRANCH SALES OFFICES

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
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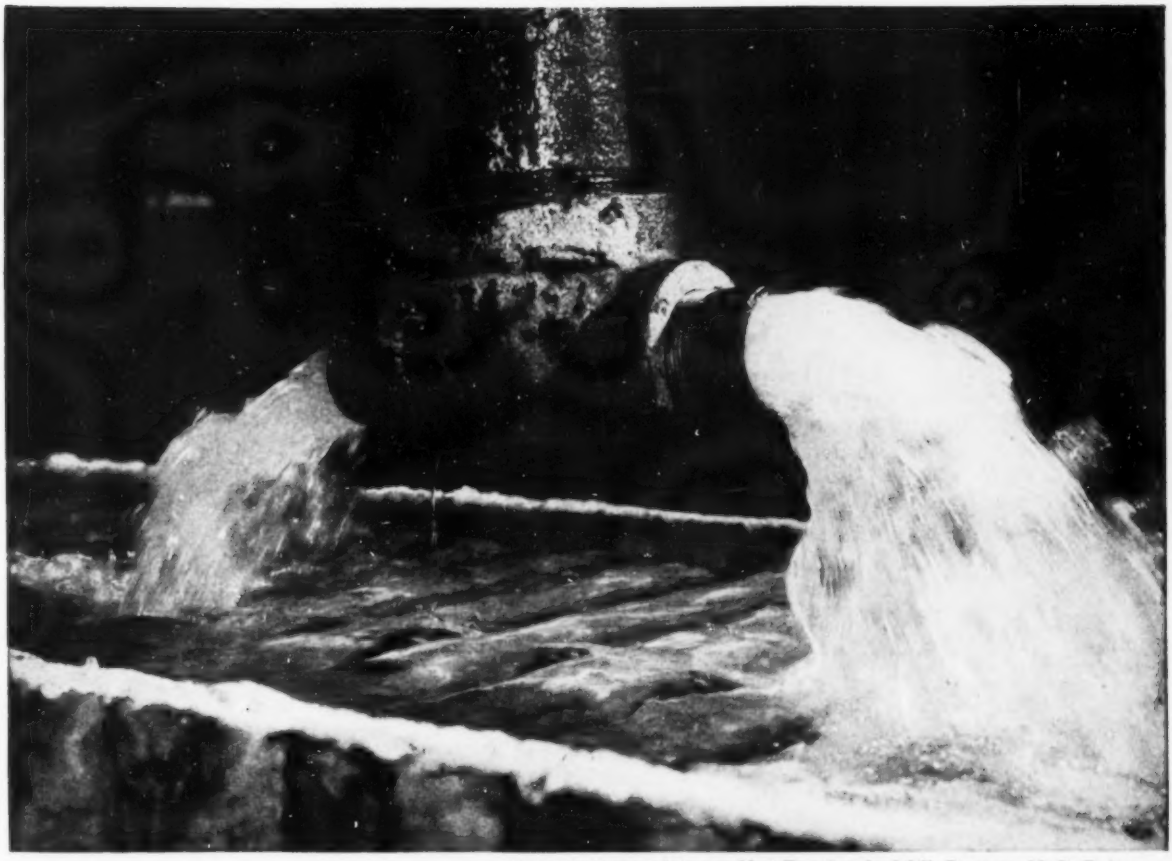


LIQUID WAX pours into a mold at Esso Standard Oil's Bayonne (N. J.) Refinery.

Solvent extraction at 200,000,000 lbs a year

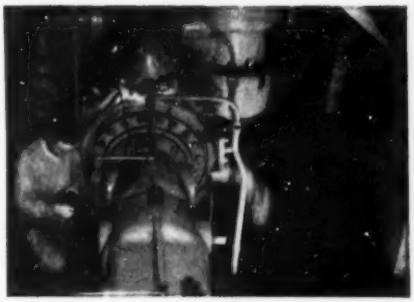
The Esso Standard Oil Company's Bayonne (N. J.) Refinery dewaxes oils by solvent extraction of chilled charge stocks. This process enables Esso to produce up to 200,000,000 lbs of oil-free wax and up to 1,000,000 gallons of wax-free lubricating oils every year.

Vital *chilling* used in this MEK dewaxing process is provided for by Worthington equipment including 3 ammonia compressors, 6 chilling machines, 6 exchangers, 3 centrifugal pumps, 2 instrument air compressors and 1 high-volume pump handling anhydrous ammonia.

As a user of Worthington refrigeration equipment, Esso is part of a long list of "big-name" Worthington users. Others include: E. I. Du Pont de Nemours & Co., Edgemore, Del., Orange, Tex.; Minnesota Mining and Manufacturing Co., St. Paul, Minn.; Shell Chemical Co., Houston, Tex.; Standard Oil Co. of California, Richmond, Calif.; Sinclair Refining Co., Houston, Tex.; Tidewater Oil Co., Bayonne, N. J.

The advantages that go along with the Worthington name are known the world over. No other manufacturer makes so complete a line. And every Worthington system is Worthington-*made*, not just Worthington-assembled — assuring you of perfectly balanced operation and unit responsibility.

Worthington Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.



PARTIAL VIEW of one of the three Worthington Balanced Opposed Ammonia Compressors (27½/16½ x 15: 900 hp), part of the Worthington equipment used at MEK plant at the Bayonne (N. J.) refinery of Esso Standard Oil Company. A-2.32

WORTHINGTON

Air Conditioning and Refrigeration

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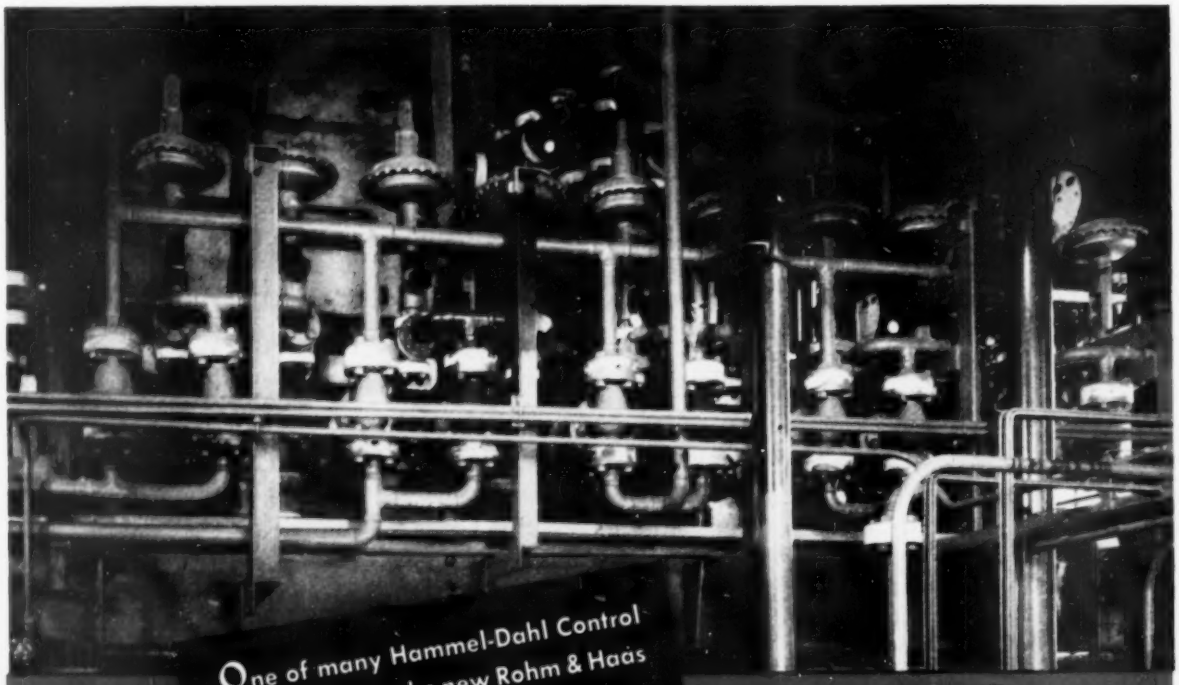
AUTOMATIC CONTROL EQUIPMENT

ENGINEERED DESIGN BY **HAMMEL-DAHL**



One of many Hammel-Dahl Control Installations in the new Rohm & Haas Plant, Houston, Texas.

ROHM & HAAS
Quality of Product *requires* Quality of Control

Consult your nearest H-D Sales Engineer for Precision Control of your Process

HAMMEL-DAHL COMPANY

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England — J. Blakeborough & Sons, Ltd., Brighouse, Yorks. • *France* — Prempfrance, Paris

HERE'S HELP

for your engineer-recruitment problem

Engineers' Joint Council and The Advertising Council offer free, expert help to advertisers promoting engineering as a career.

The booklet reproduced here was prepared by The Advertising Council in cooperation with the Engineers' Joint Council to help you make your advertising work most effectively in recruiting engineers for the future.

1. It tells you what the problem is and the important part you can play in solving it.
2. It outlines the advantages of an engineering career to help your company develop advertising appeals.
3. It informs you as to the current activities of industry in the education and recruitment of engineers.
4. It offers specific suggestions as to what you can do (from present manpower).
5. It provides material that you can use in your own local and national programs.

Many advertisers are using this booklet today. They say that it helps in orienting their engineer-recruitment advertising to industry-wide recruitment programs.

Send for this Free campaign guide
Prepared by
THE ADVERTISING COUNCIL
for the
ENGINEERS' JOINT COUNCIL

JUST MAIL THIS COUPON!

The Advertising Council, Inc.
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New York 36, New York

Gentlemen: Please send me a *free* copy of *"How your company can help promote engineering as a career."*

NAME: .....

POSITION OR TITLE: .....

COMPANY: .....

ADDRESS: .....

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The difference between Life... and Death...

"Why should you give blood? Ask me—I ought to know. I fought in Korea. But since then I've been through the biggest battle of all—the battle for life itself. And it was blood—and blood alone—that saved me. Don't know when I'll be in a position to start repaying my debt by giving some blood of my own. But I will—some day. You can count on it!"

All kinds of people give blood—for all kinds of reasons. But every reason for giving blood is a *special* reason . . . just as every American life that can be saved at any time and at any place . . . is special. So whatever *your* reason for giving blood, this you can be sure of: Whether it goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Business Executives!
✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

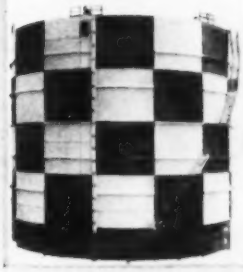
- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

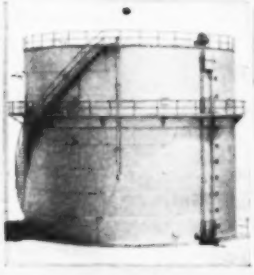
Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

users of chemical process  and industrial gases

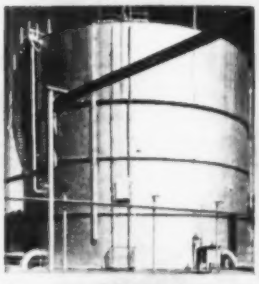
get rid of  weather-worries and operating costs

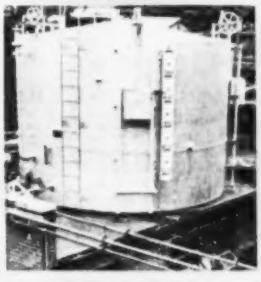
with the..

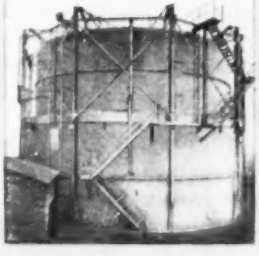
Wiggins Gasholder

by GENERAL AMERICAN

More than 50 users of Wiggins Gasholders can now testify to the remarkable savings in operating costs and maintenance expense which only this 100% dry seal gasholder (no water, no tar, no grease) gives them. Write for full information.

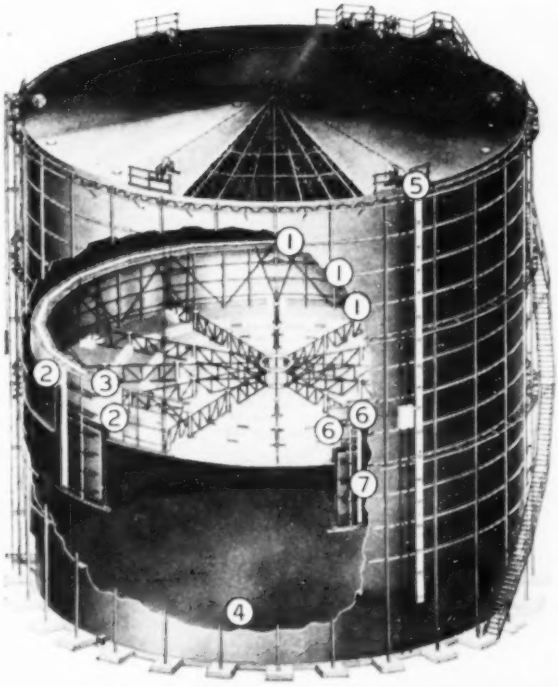






CONVERSION EASY — OFTEN ADDS CAPACITY

Your old gasholder can be quickly converted to a Wiggins type with all the Wiggins advantages.



1 TOP SECTION OF SHELL COMPLETELY VENTILATED

2 WIDE CLEARANCES SIMPLIFY OPERATION

3 GAS-TIGHT FRICTIONLESS SEAL NOT AFFECTED BY WEATHER

4 PISTON RESTS ON BOTTOM—LESS THAN ½ OF 1% FOR PURGING

5 LEVELING DEVICE—INDEPENDENT OF SIDE WALL—KEEPS PISTON LEVEL

6 FENDERS PREVENT ALL TENSION IN SEAL

7 SHELL IS GAS-TIGHT UP TO SEAL CONNECTION

PISTON RISES NEARLY TO TOP—MINIMUM OF WASTE SPACE
CAN BE BUILT ANY SIZE • NO CONTAMINATION OF GAS

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"How can I increase octane numbers . . . economically?"

"How can I make the most of my throughput?"

"What's my best bet for the years ahead?"

here's the man

with the answers!

The Perco Engineer has the answer to just about any kind of problem you might have in improving the quality of your product efficiently and economically with Perco* processes.

Perco is equipped to give you "custom made" service according to your own particular needs and problems. Without cost or obligation a Perco engineer will give you complete details about licensing Perco processes.

Over 130 installations licensed by Perco throughout the United States, Canada and Latin America prove the wide application of Perco processes to current refining problems.

Now is the time to upgrade your throughput.

Write Perco today for full information.

PERCO *Division*

Phillips 66

PHILLIPS PETROLEUM COMPANY

PERCO®
*A SERVICE MARK

Bartlesville, Oklahoma

(To obtain more data on advertised products see page 600)

PETROLEUM CHEMICALS DIVISION
NEWS

April ★ One of a Series of Interest to the Petroleum Industry ★ 1953

Du Pont's Broad Experience Helps Solve Varied Customer Problems

To a casual observer, the use of farm chemicals and that of petroleum additives would seem industries apart.

Recently, however, one of our TEL customers mentioned a serious refinery problem to his Petroleum Chemicals representative. This customer was concerned about the cost of controlling weeds and grasses around a refinery tank farm. Each year it amounted to several thousands of dollars. The reason for this exorbitant cost was that conventional weed killers had little or no effect.

The Petroleum Chemicals representative discussed the problem with Du Pont's Grasselli Chemicals Department and found that a new experimental Du Pont weed killer would do the job—at a fraction of the former cost.

The breadth of experience available in Du Pont is equalled by few other companies. Whether your problem be color conditioning, the use of explosives, stream pollution, or one of countless others, there is usually someone at Du Pont in a position to help you.

PETROLEUM LABORATORY STUDIES CARBURETOR MIXTURE PROBLEMS

A trend toward leaner carburetor mixtures is presenting a growing problem to refiners. This is especially significant since too lean a mixture can cause knock which is likely to be blamed on fuel quality.

To help refiners overcome this problem, the Du Pont Petroleum Laboratory is now studying the effect of lean mixtures on octane requirement. And to facilitate this program, several cars in the Du Pont fuel test fleet have been specially equipped for studying engine performance under varying fuel-air mixtures.

Several different types of fuels have been tested so far and it has been found that some are more sensitive than others to knocking tendencies at lean mixture settings.

This work is part of a broader Du Pont research program investigating factors contributing to knocking tendency which are not directly related to fuel quality . . . such as humidity, altitude and temperature variations.

Refiners who are encountering this type of problem are invited to consult with the Petroleum Chemicals Division's automotive specialists.

"INFORMATION PLEASE?"

Du Pont Petroleum Laboratory offers its research findings to oil companies

As a result of the research work at the Du Pont Petroleum Laboratory, much information useful to the oil industry has been accumulated.

Based on this, a number of papers and discussions have been published over a period of years by Du Pont engineers and researchers. All of this material is available to the industry through Du Pont and the various societies at whose meetings the papers are originally presented.

JAMES A. GORRY, office manager of the Petroleum Chemicals Division Wilmington office, displays several of the Du Pont papers which have proved helpful to petroleum engineers.

The literature covers a broad range of subjects of interest to oil company technical groups. It includes comprehensive and detailed information on the laboratory's studies of fuel stability, combustion chamber reactions and how engine deposits affect octane requirement.

OTHER TOPICS

There are also considerable data on the effects of sulfur compounds on octane numbers and combustion of leaded fuels. Included too, are discussions on exhaust valve performance, antiknock antagonists and temperature effects on octane requirement.

Several of the papers have received recognition as outstanding contributions to the knowledge of fuel and engine performance. For example, "Possible Mechanisms by which Combustion Chamber Deposits Accumulate and Influence Knock" and "Precombustion Reactions in a Motored Engine" won prominent awards. Both were prepared by Du Pont Petroleum Laboratory engineers.

A VALUABLE SUPPLEMENT

The work of the Petroleum Laboratory is aimed at helping refiners through basic studies which supplement their own research work. In this way the

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *"Information Please"*

Petroleum Laboratory can contribute to the over-all knowledge on which improvements in today's fuels and lubricants and new products for the future will be based.

What's more, the work of the Petroleum Laboratory is also supplemented by the more comprehensive research work of the whole Du Pont Company. As a result, many findings of the Experimental Station, the Jackson Laboratory and other Du Pont research facilities can be applied to petroleum industry uses.

If you have a technical problem on which the data from Du Pont's research work may be of help, we suggest that you talk it over with a Du Pont Petroleum Chemicals Division representative.

One of the papers by a Du Pont engineer which received outstanding recognition as a valuable contribution to fuel combustion knowledge.

NEW BOOKLET AVAILABLE ON DU PONT FUEL OIL ADDITIVE No. 2

Last month Du Pont announced the development of a new fuel oil additive. It has both dispersant and stabilizing properties and is known as Du Pont Fuel Oil Additive No. 2. Samples are now being distributed to the petroleum industry.

And to help refiners make the most efficient and economical use of the new additive, Du Pont has prepared a special booklet covering completely its physical properties, applications, effects and methods of addition. Copies are available from any of the Du Pont Petroleum Chemicals Division district offices.

Fuel Research Specialist

LEON F. DUMONT is a group leader at the Du Pont Petroleum Laboratory.

Before entering Drexel Institute in Philadelphia in 1943, he had traveled extensively in Europe and attended school for a year in Brussels, Belgium. Enlisting in the Naval Air Corps in 1944, he was commissioned an Ensign in 1946, at which time he was instructing in amphibious operations. Lee then studied mechanical engineering at Columbia University, receiving his M.S. there in 1948.

He joined the Du Pont Company immediately after college. His first assignment was with the "scavenging group," which conducts research on combustion chamber deposits at the Petroleum Laboratory.

In January, Lee was presented the Horning Award for his paper on "Possible Mechanisms by Which Combustion Chamber Deposits Accumulate and Influence Knock."

LEON F. DUMONT

He is a member of the Society of Automotive Engineers and the American Society of Mechanical Engineers.

What's the Nation-wide Trend in Octane Numbers?

That's a question frequently asked these days . . . especially in view of the fact that engine compression ratios are going higher and higher.

You'll find not only data on the nation-wide trend, but your own competitive standing as well, in the spring edition of Du Pont's Quarterly Motor Gasoline Survey. The results are due to roll off the presses in the middle of April. Refiners can expect to have copies on their desks by the week of April 27.

MOVIES AVAILABLE

Prints of the following Du Pont films are available to oil companies for training and public relations purposes. They may be borrowed or purchased. Address request to nearest Petroleum Chemicals Division district office.

Pipeline on Wheels—A 26-minute, full-color movie on tank truck safety. Suitable for both training and public relations purposes.

What Makes a Gasoline Good—An 18-minute cartoon movie in color. Presents the story of how high quality gasoline is made in easy-to-understand form. Ideal for dealer training meetings.

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. . . through Chemistry

Petroleum Chemicals

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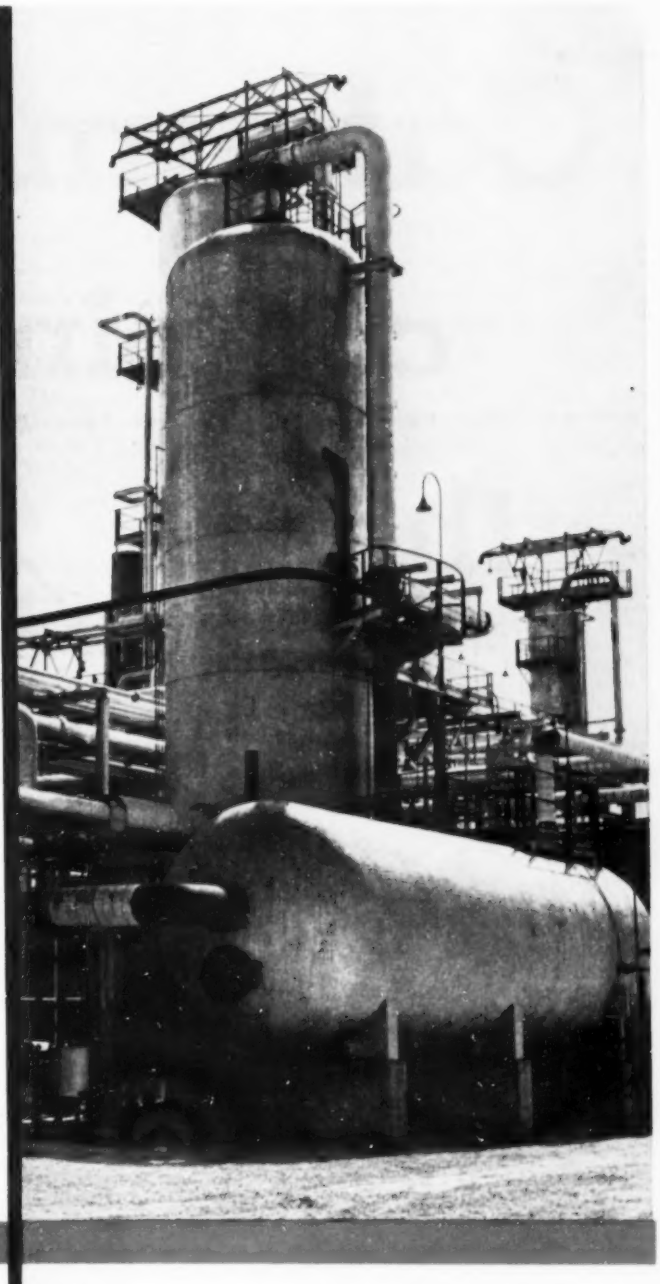
WHEN YOU NEED *Desalting*

BE SURE YOU GET SERVICE

Desalting, like any other refining process, should be designed, supervised and serviced by specialized experts. Many years of chemical desalting experience have convinced the Tretolite Company desalting engineers that complete service is necessary if efficient desalting is to be attained. Since the Tretolite Company pioneered chemical desalting, and since Tretolite currently is being used to desalt over a million and a half barrels of crude per day, we believe that these conclusions have a factual foundation.

The attainment of efficiency in chemical desalting just begins with the preliminary tests, specification and sale of the treating chemical. The treating plant must be designed to give the most efficient flow, proper heating, correct contacting and necessary residence time. All these are factors of design — important factors with which Tretolite desalting engineers are fully conversant.

At Tretolite, we believe that we can *sell* you the best desalting chemicals available; we will *give* you the best service.



Tretolite Desalting Service provides:

1. **Preliminary performance-prediction tests**
2. **Plant design assistance, drawings and consultation**
3. **Construction advice and supervision**
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5. **Instruction of refinery personnel**
6. **Continuing service and periodic inspections**

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DESALTING • DEHYDRATING • CORROSION INHIBITING • SCALE PREVENTING • WATER DE-OILING • PARAFFIN REMOVING

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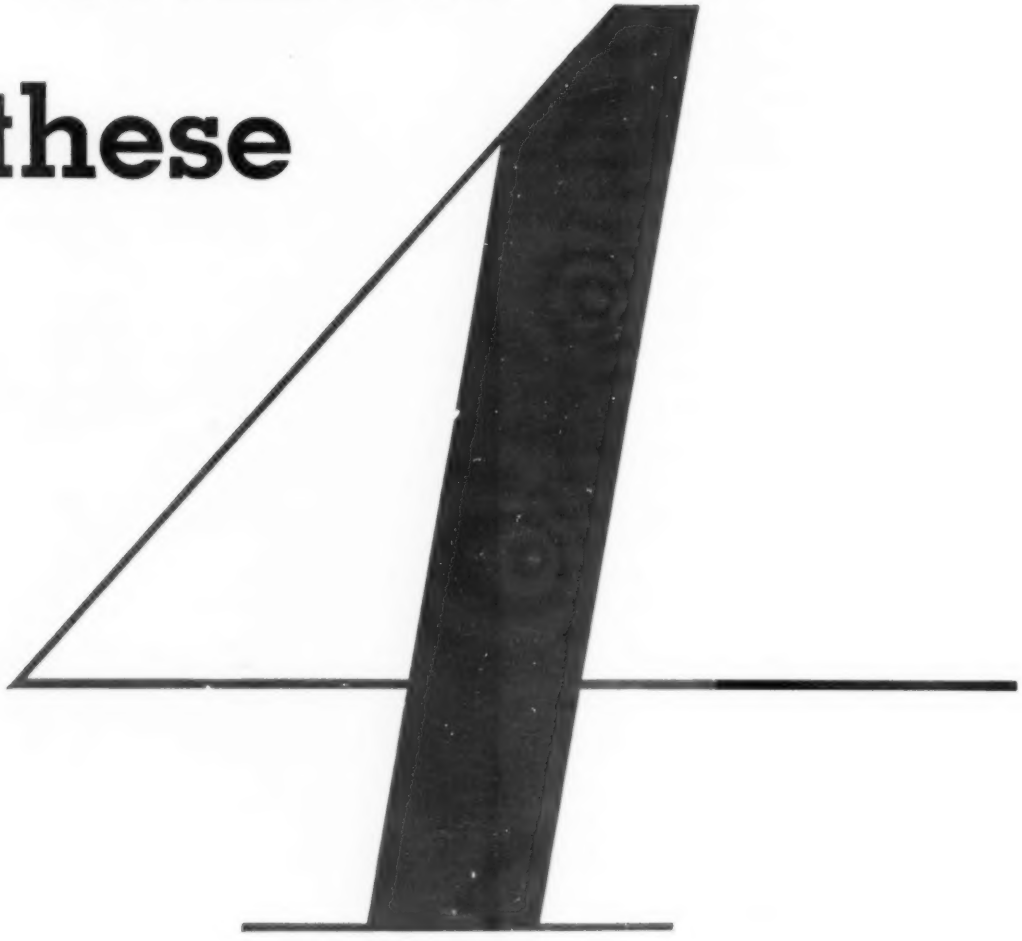
(To obtain more data on advertised products see page 600)

Catforming combines these



advantages

(To obtain more data on advertised products see page 600)

The Atlantic Catalytic Reforming Process brings you:

1. high yield

The Atlantic Catforming Process was specially designed to produce high octanes at high yields. It properly balances all the many reactions necessary for the production of high octanes, assuring you of a high yield-octane relationship and maximum liquid recovery of high octane products from any feed stock.

2. low cost

Catforming units can be designed by *your own* contractor, thus providing important economies and greater simplicity. Commercial units of from 750 to 12,000 BPD charge capacity are now being built at investment costs of only $250 to $400 per barrel. In operation, no feed preparation, product finishing or costly regeneration facilities are needed.

3. stability

The catalyst in the Atlantic Catforming Process retains reforming activity for extensive periods, and at the same time has no loss in selectivity. Even under the varied conditions encountered in normal refining operations, catalyst life is from 35 to 100 barrels per pound.

4. ruggedness

Activity and selectivity of the Catforming catalyst are virtually unaffected by water, sulphur compounds, and nitrogen compounds normally encountered in naphtha reforming. Atlantic's catalyst has *proved* its ability to resist physical and chemical change.

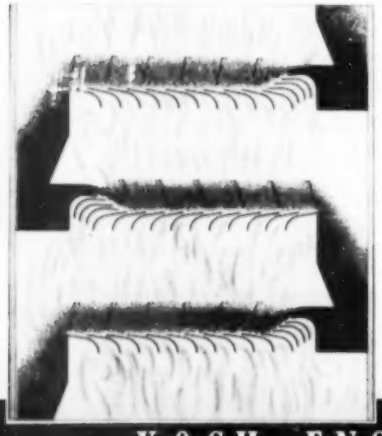
FOR COMPLETE DETAILS call or write The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia 1, Pa. (Telephone, Howard 5-2345.)

It's the catalyst that counts

ATLANTIC

Photo courtesy of Oregon Game Commission

If high liquid volume is your problem



IT WILL PAY YOU TO INVESTIGATE THE HIGHER LIQUID HANDLING CAPACITIES OF KOCH "BENTURI-TYPE" KASKADE TRAYS...THE DIRECTED SLOT ENERGY ACTUALLY ASSISTS THE LIQUID ACROSS THE TRAY.

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Where dirt, dust and corrosion are a problem...

TYPE E turbines can handle it!

Spencer Chemical Company of Pittsburg, Kansas, has a total of ten 47-hp Type E turbines for driving blowers. Units are mounted outdoors on structural steel and are exposed not only to the elements, but to a corrosive ammonium-nitrate atmosphere.

Continued satisfactory operation of the turbines under these conditions is proof that the Type E can "take it" . . . proof that Type E construction keeps foreign matter out . . . proof that materials used resist corrosion and erosion.

Weather and corrosion resistance are important . . . in the chemical industry and in other industries as well. Important, too, are other Type E features, such as dual protection against overspeed, floating movement of governing and trip linkages, centerline support, parts interchangeability between wheel sizes. Outstanding Type E design assures safe, trouble-free, economical performance for long periods of continuous operation . . . or instant operation when used as a stand-by drive.

Other types in the complete Westinghouse general-purpose turbine line include heavy-duty and multistage units.

Get the facts from your nearby Westinghouse office, or write for twenty-page book B-3896. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30542

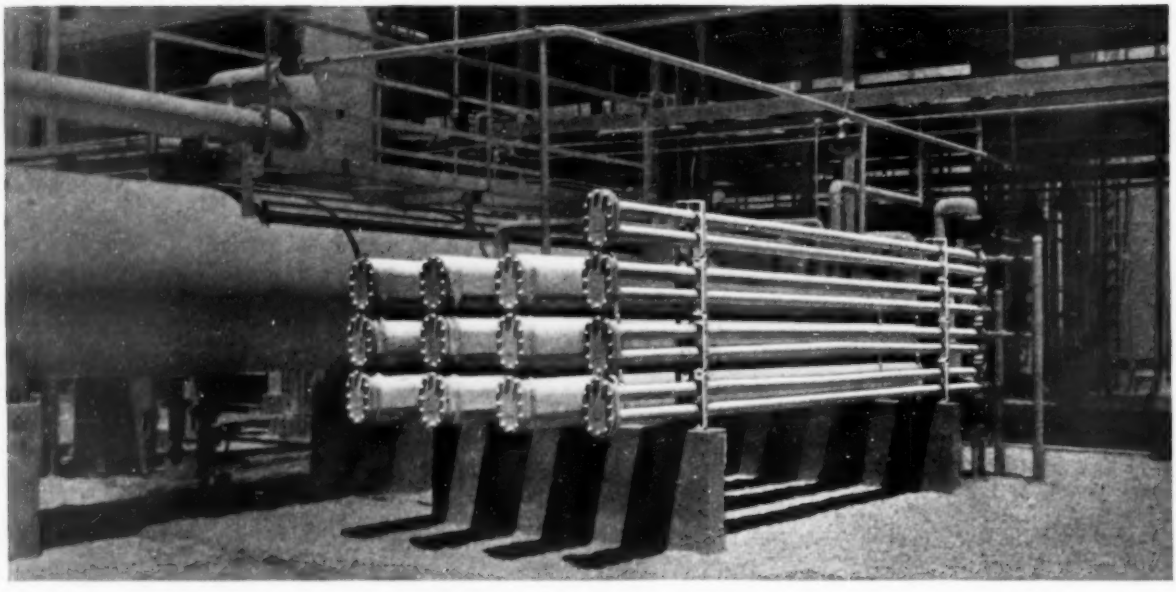
YOU CAN BE SURE...IF IT'S

Westinghouse

TYPE E Turbines

Assure Flexibility

in your plant with



BROWN FINTUBE *Sectional* HEAT EXCHANGERS

● Production schedules — and processing techniques change. Consequently, you can never know positively, what your fluid heating and cooling needs will be next year — or even next week. Because Brown Fintube Heat Exchangers consist of *standard sections* connected in proper series-parallel arrangement, they can be rearranged easily and quickly to meet changing conditions.

You simply add, or remove, a few sections, or change the series-parallel manifolding. The plant can be operating efficiently, on almost any new duty, on short notice,— and with a minimum investment in new equipment. "Bundle" type exchangers are not flexible. For them a change involves the delay and expense of designing — and waiting — for a whole new unit.

Flexibility is only one of Brown Fintube's many advantages. You'll find full details in our Bulletin No. 512. Send for a copy. It will give you ideas.

BROWN FINTUBE CO.
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● Integral One-piece Fintubes; Sectional Heat Exchangers and Coolers; Vertical Heaters for Bulk Storage Tanks; Tank Suction Heaters; Pressure and Suction Line Heaters; Process Tank Heaters; Fired Indirect Heaters and Special Types of Fintube Heaters and Coolers.

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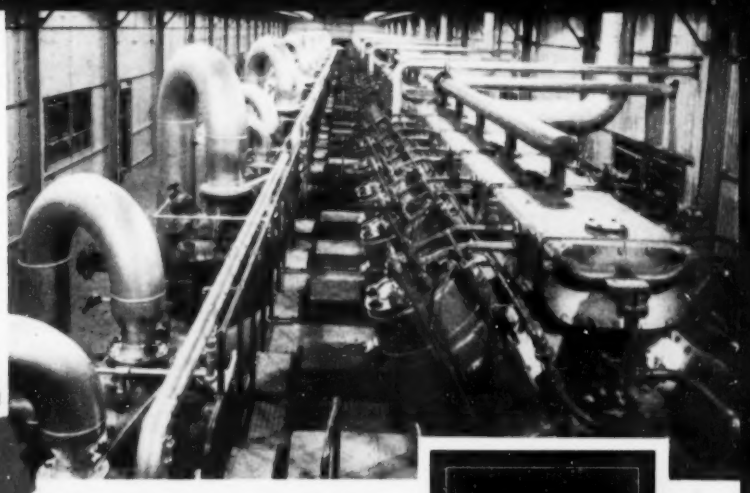
IN THE LATEST SCURRY COUNTY PLANT

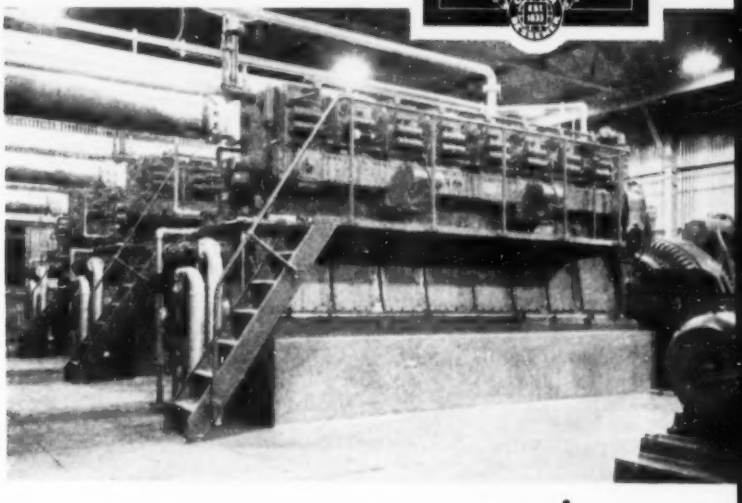
modern Cooper-Bessemers team up for a big 3-way job



This compressor line-up in the Fuller plant now consists of 880 hp GMV-8-TF units and 1100 hp GMV-10-TF units. Each unit is equipped with a high pressure cylinder for injection service.

These Cooper-Bessemer turboflow, spark-ignited four cycle gas engines drive 500 K.W. generators to provide electric power for the operation of all pumps, air compressors and similar equipment.

Another Example of Efficient Power at Lower Cost



GMV's *for processing and injection*

JS's *for electric generation*

THE Fuller plant in Scurry County, Texas, operated by The Texas Company for the account of the Cogdell Field operator-owners, is one of the newest combination gasoline and pressure maintenance plants to go on stream. Designed and constructed by the O. L. Olsen Company, it has been winning high respect for its latest methods, modern facilities and efficient operation.

Here, as in so many other newsworthy plants, you'll find Cooper-Bessemer units at the heart of the operation. GMV compressors handling process and injection gas — JS gas engines driving 500 K.W. generators.

Check up. You'll find that *your* power needs, too, can best be met with modern Cooper-Bessemers.

The **Cooper-Bessemer** *Corporation*

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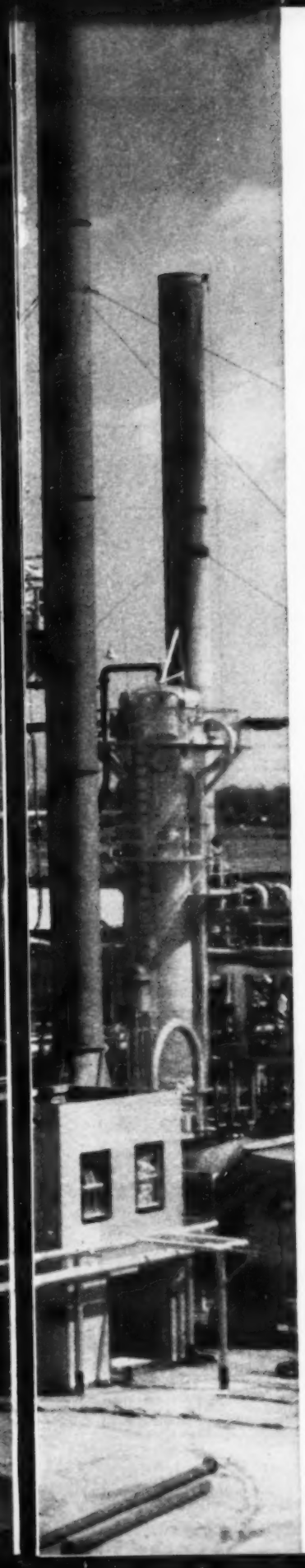
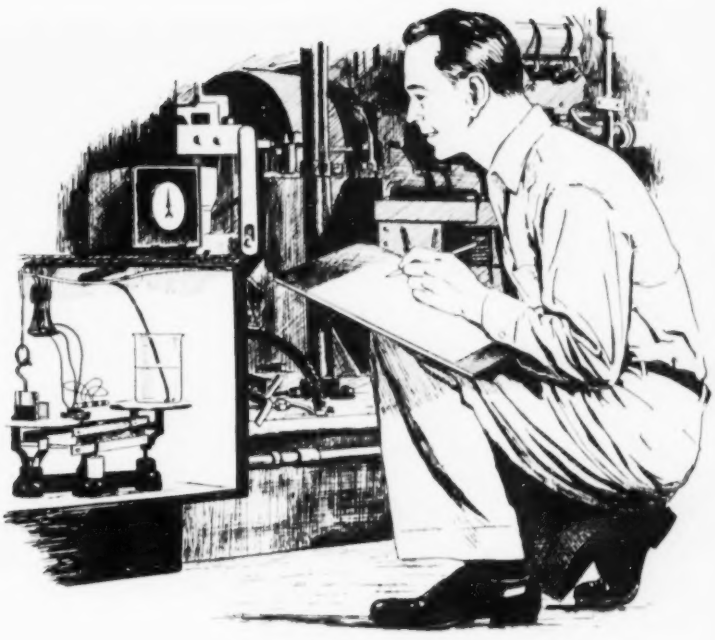
DID YOU KNOW THAT
UNIVERSAL SERVICE PROTECTS
YOUR INVESTMENT 7 WAYS?





U O P COLLATERAL SERVICES PROTECT YOUR INVESTMENT

In addition to its research work the Universal laboratory provides correlated services which contribute substantially to the successful operation of the refiner's processing equipment.

Extremely important is the evaluation of crudes of all types from fields all over the world. Thus the composition of a particular crude oil can be determined, problems of treating gasoline solved, performance of gas concentration equipment checked, and finished products examined.

Equally important is the analysis of engine fuels through the use of special equipment both in the laboratory and road test cars. Such examinations not only determine the operating characteristics of a specific engine fuel but also serve as a guide to constant improvement in product manufacture.

These collateral services are valuable to *every* refiner and especially to the company that does not find it feasible to handle such work within its own organization.

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Universal Service Protects Your Investment through laboratory research . . . pilot plant studies . . . design and engineering . . . construction supervision . . . licensee instruction . . . post on-stream service . . . collateral services.

Spheres "Bed" Perfectly in catalytic processing. In Norton Spherical Catalyst Supports you get uniform beds that promote uniform flow of gases and assure minimum pressure drop. Spheres are available in sizes 3/16" to 1". Supports in Ring and Pellet form in sizes 1/8" to 2".

Catalyst supports to your special prescription

. . . Norton engineered for your special requirements

Where catalyst supports were applicable Norton engineers have been successful in meeting the requirements of a large variety of conditions.

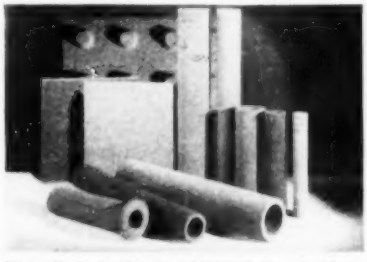
Over 40 years' experience in research and developments of special refractory materials and mixtures have enabled Norton to tailor special refractory mixtures to meet the requirements of the chemical industry.

ALUNDUM* Catalyst Supports are a good example. They have such qualities as great refractoriness, chemical inertness, strength and high resistance to abrasive action. They are made by Norton's exclusive "controlled structure" process. It provides medium porosity of 30-35% with rough open structure for maximum adherence of catalyst, or high porosity 42-47% with large connected internal pores, uniformly dispersed for maximum deposition of the catalyst.

Test them yourself

See what Norton ALUNDUM Catalyst supports can do for you. If you would like to see samples, see your Norton refractories representative or write Norton Company, 263 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

Norton Exclusive Fused Stabilized Zirconia, an amazing material able to take temperatures double the melting point of most metals. No other refractory is so chemically stable at such high temperatures. (Up to 4700° F.) Ask for Bulletin 793.



Norton Exclusive. Norton ALUNDUM *Seamless* Tubes for filtration, aeration, diffusion maintain constant air or liquid pressure. ALUNDUM porous mediums also available in plates, discs and diaphragms. Ask for Bulletin No. 140.

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Making better products to make other products better

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In the Petroleum Industry

Where performance counts you can count on Enjay for .....

Uniform, High Quality

PARATONE®

VISCOSITY INDEX IMPROVERS

A pioneer and leading marketer of viscosity index improvers, the Enjay Company is meeting the Petroleum Industry's constantly increasing demand for PARATONE. Refiners and marketers of High V. I. motor oils with product specifications that call for both maximum on-the-road performance and economical treating cost use ENJAY PARATONE for improving viscosity index.

ENJAY

A complete line of dependable products for Industry

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PARADYNE	Secondary Butyl Acetate	Decyl Alcohol
PARATAC	Isopropyl Acetate	Trideeyl Alcohol
PETROHOL	Acetone	Dicyclopentadiene
Methyl Ethyl Ketone	Methyl Ethyl Ketone	Isoprene
Dewaxing Aid	Ethyl Ether	Butadiene
Ethyl Ether	Isopropyl Ether	Ethyl Ether
Isopropyl Ether	Dicyclopentadiene	Isopropyl Ether
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	Iso-Octyl Alcohol	Tetrapropylene
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The Enjay Company has long been recognized as a leader in the development and marketing of high-quality products for the oil, surface coating and chemical industries. Backed by greatly expanded plant and distribution facilities, the Enjay Company is supplying a constantly growing list of chemical products to many different industries.

BE SURE TO CALL ON ENJAY FOR YOUR CHEMICAL NEEDS

ENJAY COMPANY, INC.

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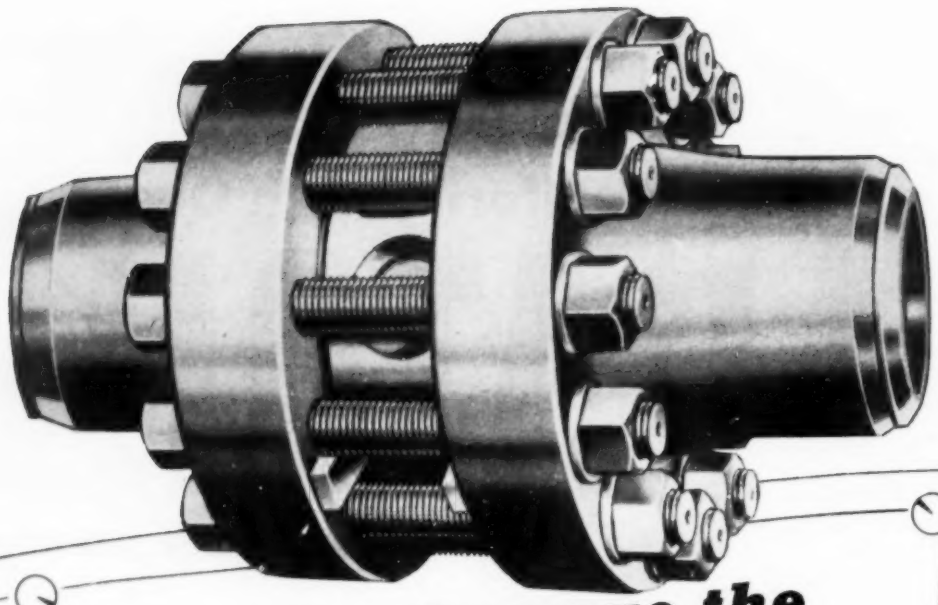
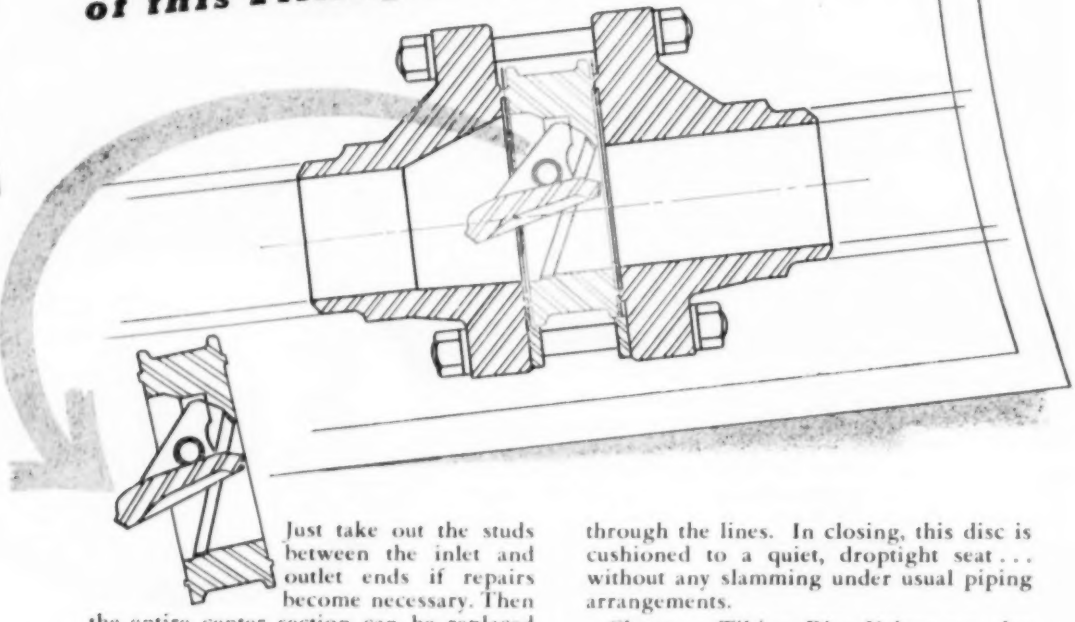


You Can Remove the Center Section

of this Tilting Disc Check Valve



Just take out the studs between the inlet and outlet ends if repairs become necessary. Then the entire center section can be replaced . . . quickly and easily. No need to cut the valve out of a welded line.

The Tilting Disc Check Valve has the advantage of smooth, easy operation because of the balanced disc, which rides steadily and without fluttering in the flow through the lines. In closing, this disc is cushioned to a quiet, droptight seat . . . without any slamming under usual piping arrangements.

Chapman Tilting Disc Valves are also available in the standard two-piece design, in either iron or steel, for all pressures. Write for full details and prices to

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASS.

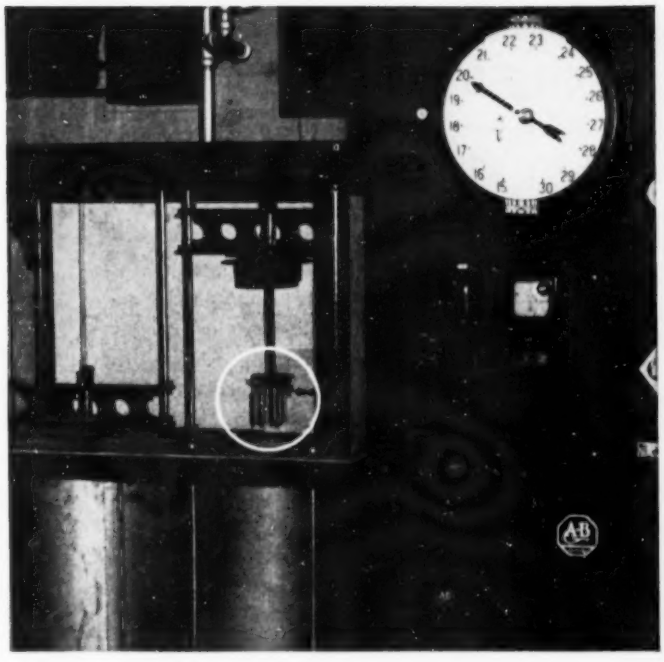
CHAPMAN 3-PIECE (TILTING DISC) **CHECK VALVES**

(To obtain more data on advertised products see page 600)

SCALING RESISTANCE

EVALUATED AT

HIGH TEMPERATURES



High-Temperature Corrosion Often Is the Main Factor in Metal Failure

Learning why metals fail at high temperatures – determining the actual cause of damage and suggesting as a remedy a more suitable material—these are the jobs of INCO High-Temperature Engineers, who are getting information on such problems for the use of industry.

INCO laboratories in Bayonne, N. J., and Huntington, West Va., have useful data on the properties of metals at elevated temperatures. This information comes from tests made to determine the creep strength, stress-rupture, and other properties of materials at temperatures in some cases up to 2100°F.

Industrial experiences at high temperatures indicate that it is unwise to predict high-temperature performance on the basis of room-temperature properties or short-time high-temperature tests. Other methods have been developed that provide more accurate measures for judging materials.

The machine pictured above was especially designed by INCO Engineers for determining the effect of cyclic heating and cooling on sheet metals while exposed to oxidizing conditions. INCO High-Temperature research likewise covers damage by other corrosive atmospheres. Through work with this and other types of equipment INCO Engineers study the reasons for failure of alloys at high temperatures.

Due to the volume changes accompanying its formation, an oxide film formed at high temperatures on the surface of a metal or alloy is usually under compressive stress. Contraction stresses developed when the underlying metal is cooled further aggravate this situation – and with many alloys may cause rupturing of the normally protective oxide.

Among the factors which influence the resistance to oxidation, the physical characteristics of the formed scale are of importance. The sketches show how these characteristics may cause the breakdown of the scale and thus increase the rate of oxidation.

Blistering may occur in oxide layers having good elasticity but poor adherence to the metal surface.

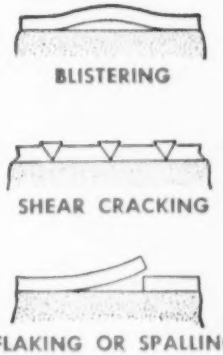
Shear cracking on the other hand will be found in oxides that are adherent but relatively brittle.

Flaking or spalling results when the oxide is both brittle and non-adherent.

As the scale peels away from the metal, it exposes a fresh area to further attack. A point of importance is that the loss of the oxide causes a progressive loss in metal section—useful load-carrying metal.

In high-temperature applications employing sheet or strip, the necessity of obtaining maximum resistance to this form of destruction by selection of a suitable heat-resisting alloy is of greatest importance.

Oxide Scale Breakdown by:



If high-temperature alloy performance is a problem to you, whether in present activities or in new projects, INCO High-Temperature Engineers will do their best to be of help to you. Let them send you the *High-Temperature Work Sheet* . . . it is a big aid in explaining your situation fully. Then see if INCO Engineers cannot help solve your difficulty.

EMBLEM OF SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

(To obtain more data on advertised products see page 600)

name your refinery equipment needs

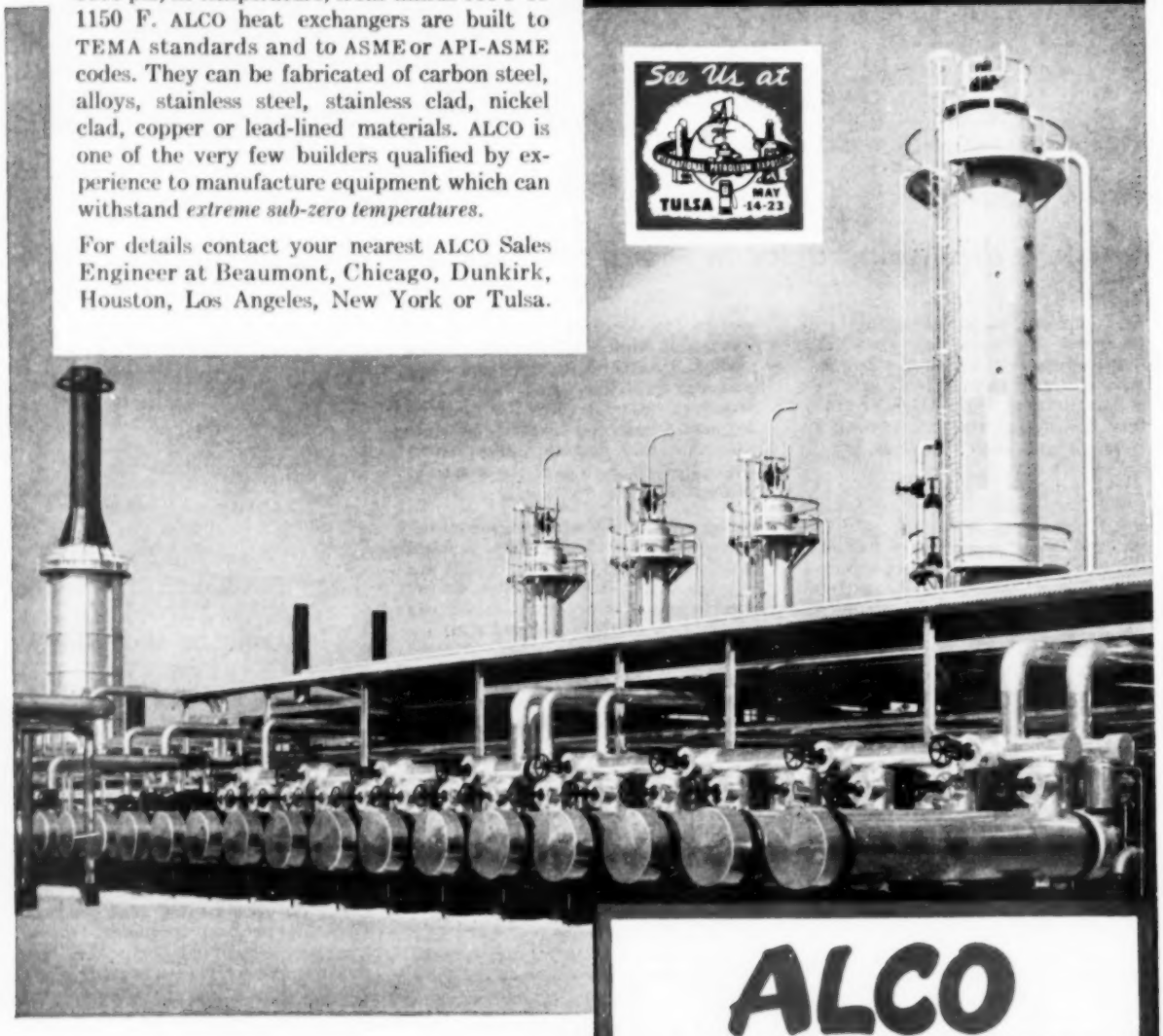
Custom engineering . . . that's the secret of ALCO's success at meeting virtually all of the refining industry's many equipment requirements.

Rugged ALCO products have been produced to cover an extremely wide range of requirements. Units vary in diameter from four inches to twelve feet; in weight, from 100 to 300,000 pounds; in pressure, from high vacuum to 3000 psi; in temperature, from minus 300 F to 1150 F. ALCO heat exchangers are built to TEMA standards and to ASME or API-ASME codes. They can be fabricated of carbon steel, alloys, stainless steel, stainless clad, nickel clad, copper or lead-lined materials. ALCO is one of the very few builders qualified by experience to manufacture equipment which can withstand *extreme sub-zero temperatures.*

For details contact your nearest ALCO Sales Engineer at Beaumont, Chicago, Dunkirk, Houston, Los Angeles, New York or Tulsa.

piping
pressure vessels
heat exchangers
product filters

ALCO can meet them



ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Dunkirk, N. Y.

(*To obtain more data on advertised products see page* 600)

TRADE PAPER EDITION
Published by
SCHUTTE and KOERTING Company

ENGINEERING News

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • SOOTBLOWERS • TUBE CLEANERS • GASOLINE PLANT EQUIPMENT • STEAM JETTED AND MECHANICAL VACUUM PUMPS • GAGE COCKS • CONTROLLERS

Jet Eductors Handle Gasoline Dyes For Standard Oil of California

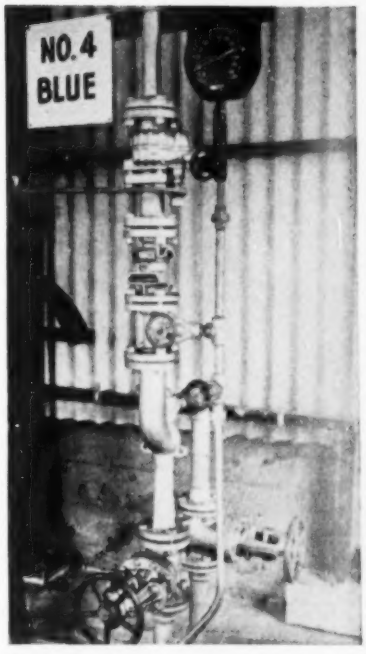
Condensed from ETHYL NEWS with permission of Ethyl Corporation.

A system for handling light, easily scattered, and extremely penetrating gasoline dyes which has attracted considerable interest among refiners is that installed by the Standard Oil Company of California at its El Segundo refinery. This system makes use of SK 1½" Fig. 222 Jet Eductors to transfer the dye, with the gasoline blend serving as the motivating, or driving, fluid.

A container of dye is placed on a scale and weighed. If, for instance, 300,000 gallons of motor fuel are to be dyed, and the dye requirements are 1.5 grams per 100 gallons, then 4,500 grams or about 10 lbs. of dye are necessary. With the proper color dye on the scale, the operator notes its weight and the reading at which he should stop the addition of dye. He inserts a flexible hose into the dye container, opens the eductor valve, and draws the proper amount from the container. After the required amount of dye has passed through the eductor, "wash" gasoline is flushed through the eductor and its connecting lines to clean them. The balance of the mixing operation —to obtain a proper proportion of dye to gasoline—is completed in the storage tank.

Separate eductors are used for each color of dye in order to avoid improper mixing. In addition, this system allows the use of individual scales for each color permitting the use of sensitive scales and avoiding the necessity for multiple handling of dye barrels. Standard of California has found a number of advantages in its system. Dyes can be weighed accurately and added to gasoline without spilling. Time is saved by avoiding the intermediate step of making dye solutions. Turbulence in the eductor and loop lines provides sufficient mixing to put the dyes into solution. And, the system provides ease in operating and cleaning, adequate facilities for storing and handling dyes, and economical operation.

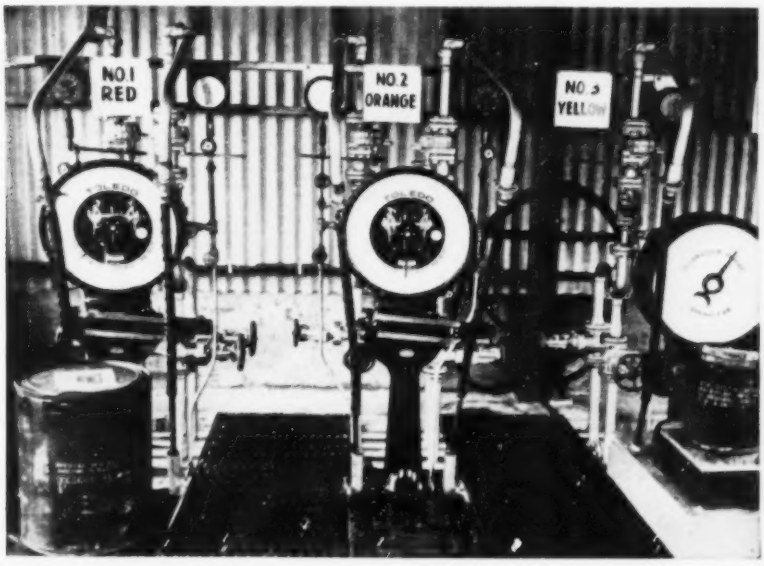
For complete details on SK Jet Eductors, request Bulletin 2-M.



◀ Closeup of an SK Fig. 222 Jet Eductor as used in Standard Oil of California's Dye Handling System.

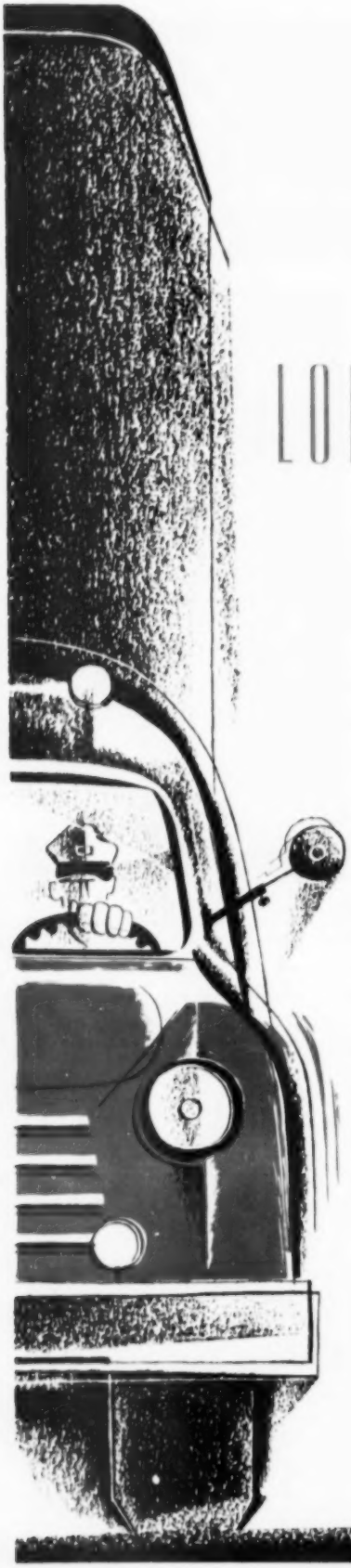
BULLETIN ON HEAT TRANSFER

SK Bulletin HT-1 pictures and describes standard heat exchangers, generator air coolers, feed water heaters, oil heaters, straight tube evaporators and duplex strainers. Dimensions for various sizes are included in tabular form. Copies available on request.



◀ Photo shows three of the dye eductor manifolds with adjoining scales.

SCHUTTE and KOERTING Company
Manufacturing Engineers
35 CORNWELLS HEIGHTS
BUCKS COUNTY, PA.
Representatives in Principal Cities



LONG HAUL... OR SHORT HAUL...

THERE'S A SANTOLUBE OIL ADDITIVE TO IMPROVE EVERY KIND OF ENGINE PERFORMANCE

Truck engines that pull heavy loads and run for long periods of time at high temperature . . .

Passenger car engines that pull light loads and run for short periods at low temperature . . .

For both these extremes of operation—as well as the full range in between—Monsanto makes a complete line of Santolube oil additives. They can be added to numerous base stocks and be custom-fitted to the kind of oil you produce. More important, these additives will help your oil fight corrosion, inhibit oxidation, keep engines clean, reduce engine wear.

Here are a few of the kinds of additives made by Monsanto:

- Pour point depressants
- Motor oil inhibitors
- Viscosity index improver
- Gear lubricant additives
- Motor oil detergents
- Corrosion inhibitor for distillate fuels
- Sludge inhibitor for domestic oil fuels
- Cutting oil additive
- Inhibitor detergent combinations for premium and heavy-duty service

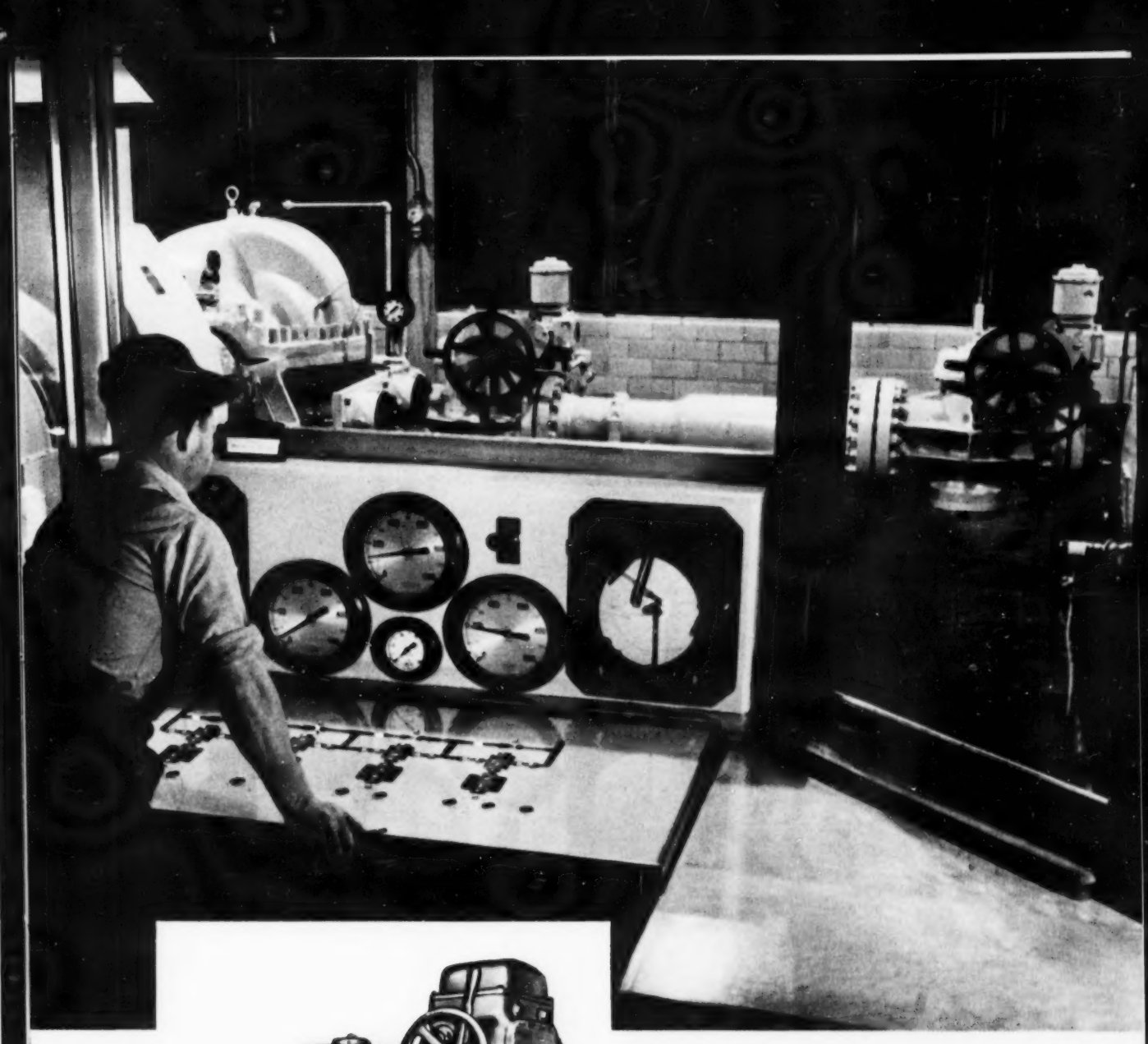
Write for more information to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.

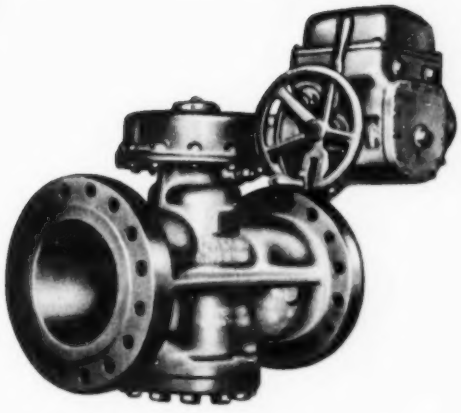
Santolube: Reg. U. S. Pat. Off.

SANTOLUBE

MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND





Rockwell | **Built Nordstrom Valves**

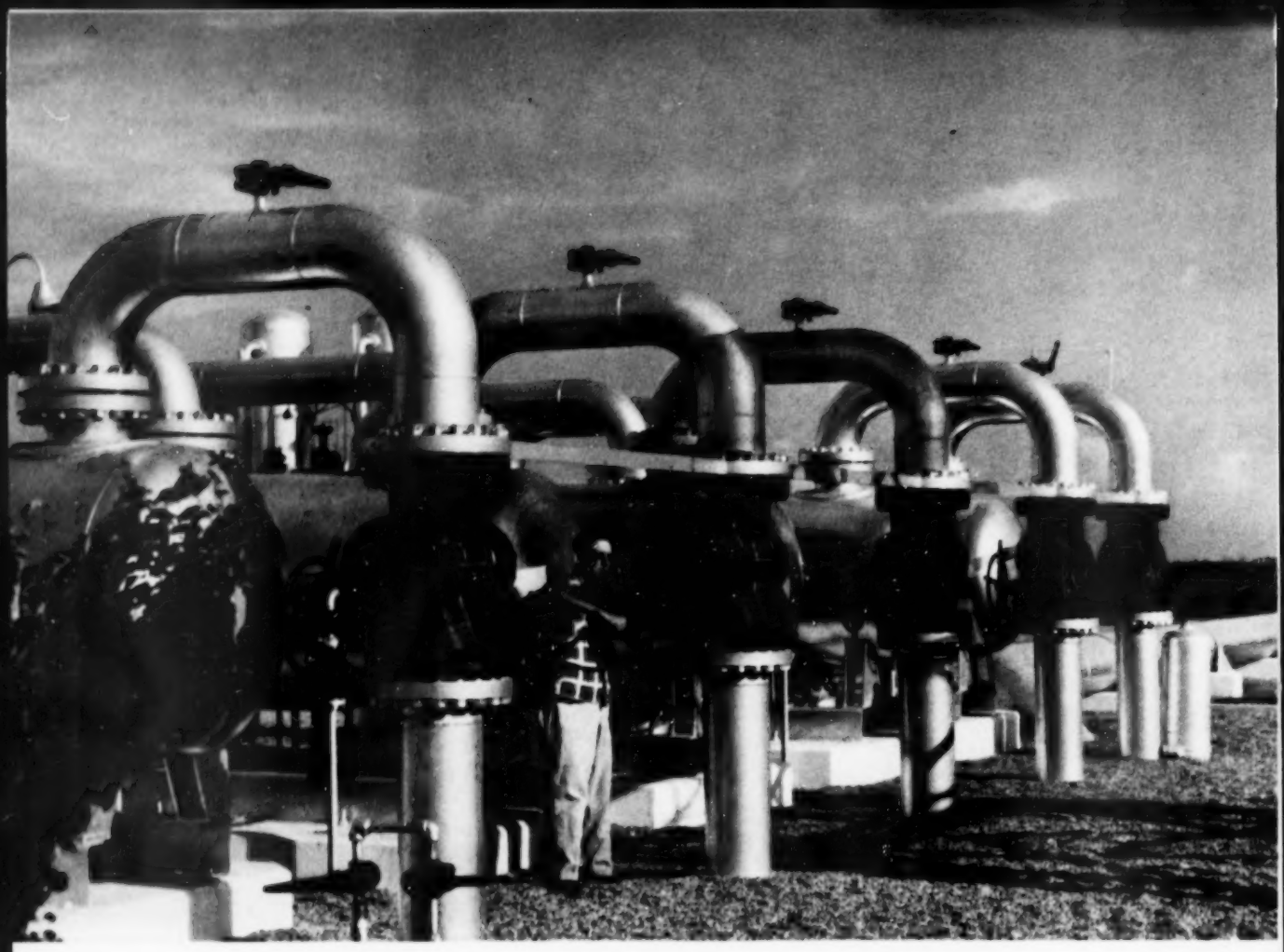
Another Rockwell Product

LUBRICANT SEALED TO KEEP UPKEEP DOWN

NOW WITH NORDSTROM

You Can Centralize and Mechanize Flow Control

With Nordstrom automatic control valves a single panelboard operator can completely command all lines of flow. From one location, he can tell at a glance which lines are open and which are closed. In an emergency, operation is instant. Complex batching and blending processes, dependent upon timed cycles, become simple. Manpower is saved. Valves miles away can be operated at the touch of a finger. Nordstrom power operated valves enable you to mechanize your flow control and centralize flow line operation.



From Field to Flame Through Nordstrom Valves

At each stage, from the time it comes from the ground, through processing, pipe line, distribution and finally use, natural gas is controlled by Nordstrom valves.

The same can be said for petroleum.

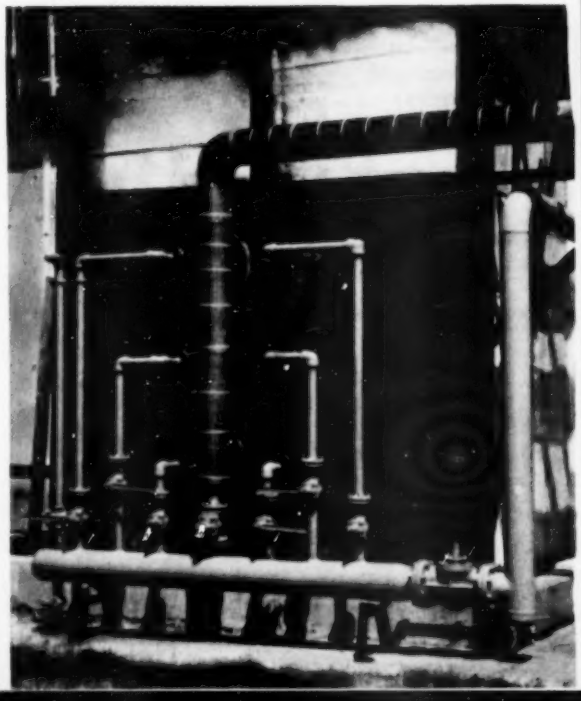
The same can be said for many chemicals.

Nordstrom valves have been used successfully in perhaps more different kinds of difficult services than any other type of valves. You find them in virtually all types of industrial process lines.

Why?

Because, with the original Nordstrom internal lubrication system they seal tighter, open more easily under pressure, let flow straight through, and have no gas—or fluid catching pockets to start corrosion or erosion.

Nordstrom valves and Nordstrom service are available by distributors everywhere. Rockwell Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa.



Rockwell | **Built**

Another Rockwell Product | **Nordstrom Valves**

LUBRICANT SEALED TO KEEP UPKEEP DOWN

ATTAPULGUS Fullers Earth
POROCEL Activated Bauxites

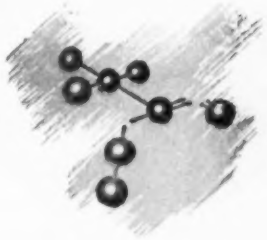
...two reliable names along the path of petroleum processing

WHAT DO YOU WANT TO PURIFY?

There's an Attapulgus or Porocel adsorbent to fit your process technique for removing odors, colors, tastes, moisture, acids, sulfur, fluorides and unsaturates from process liquids or gases. Materials treated in principal applications are: motor oils and other lubricating, specialty, and technical oils; petrolatums and waxes; aviation and motor gasoline stocks; kerosene; diesel and heating oils.

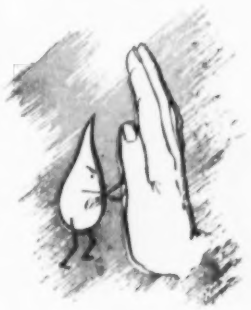
DO YOU HAVE CATALYST OR CATALYST CARRIER NEEDS?

Attapulgus or Porocel sorptive minerals are recognized standards in desulfurization, reforming and isomerization systems—catalytic removal of unsaturates—conversion of sulfides to elemental sulfur—fluid catalyst applications—as catalyst carrier in copper sweetening processes.



WHAT DO YOU WANT TO DRY?

We offer a wide range of reliable, thoroughly proved desiccants for drying air, hydrogen, carbon dioxide, hydrocarbon liquids and gases.

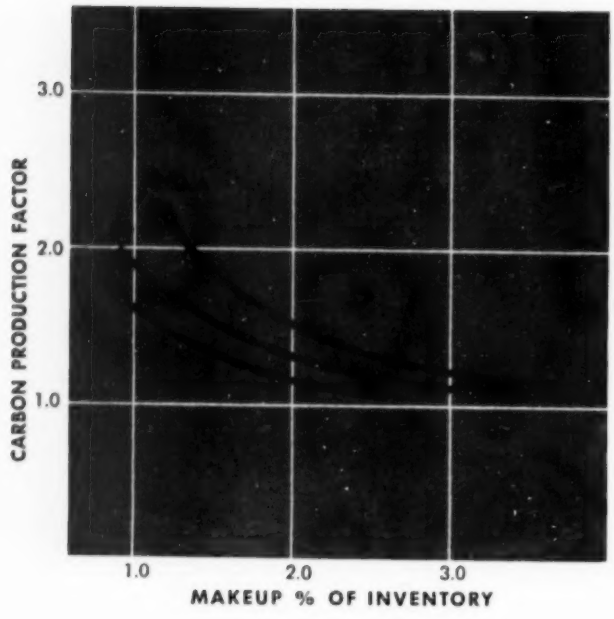


SPECIAL GRADES?

Mine and plant facilities permit prompt and economical production of grades meeting individual customer specifications. Our laboratories and technical staffs welcome the opportunity of assisting in research, development, design and operating problems. Your inquiries are invited.

ATTAPULGUS MINERALS & CHEMICALS CORPORATION • POROCEL CORPORATION

Dept. D, 210 West Washington Square, Philadelphia 5, Pa.



Optimum Catalyst Selectivity For Your $$

OTHER
REASONS FOR USING
FILTROL CATALYSTS

1. Higher Octane Barrels
2. High Butylene Yields
3. Sulphur Resistant Catalysts
4. Faster Regeneration Rate
5. Low Attrition Rate
6. Technical Service
7. Uniformity
8. Lowered Excess Butane
9. Varied Plant Facilities

MANY TYPES OF FEED STOCKS CONTROL CRACKING CATALYST SELECTIVITY, PARTICULARLY WHEN OBTAINED BY CUTTING DEEPER INTO CRUDES.

THE LOW COST FILTROL CATALYSTS GIVE BETTER SELECTIVITY PER DOLLAR EXPENDED. FOR EXAMPLE, WITH A CONTAMINATING FEED STOCK, CARBON PRODUCING FACTORS (CPF) FOR VARIOUS CATALYSTS PER $1000 PER DAY CATALYST EXPENSE ARE AS FOLLOWS:

UNIT CATALYST COST	TONS/$1000	CPF
$350/TON	2.86	2.0
$155/TON	6.35	1.4
$100/TON	10.0	1.2

AT CARBON BURNING LIMITATION EXTRA CAT CRACKER THROUGHPUT AVAILABLE BY REDUCING CPF IS:

CPF	**PERCENT INCREASE IN THROUGHPUT	APPROXIMATE EXTRA INCOME
2.0		
1.4	23.5	$ 9,000
1.2	36.5	$14,500

**Basis catalytic cracking operation at 30,000 B. D throughput.

Filtrol*

FILTROL CORPORATION

OFFICES: 727 WEST SEVENTH STREET, LOS ANGELES 17, CALIFORNIA
PLANTS: VERNON, CALIF.; SALT LAKE CITY, UTAH; JACKSON, MISS.

CATALYSTS AND ADSORBENTS

*T. M. REG. U. S. PAT. OFF.

Fig. 375—200-pound Bronze Gate Valve with renewable, wear-resisting "Powellium" nickel-bronze disc.

The name "POWELL" on a valve assures absolute dependability

Naturally, in buying a valve, the first consideration is its ability to perform a specific service. But that is not all. For it must also be a valve that will continue to function dependably for a long time. Powell Valves have an established reputation for absolute dependability.

The Wm. Powell Co.
Cincinnati 22, Ohio

POWELL

DEPENDABLE VALVES SINCE 1846

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

MIDWEST

The Only Change is in the Name

MIDWEST PIPING & SUPPLY CO., INC.
has Changed its Name to

Midwest Piping Company, Inc.

6283

Because the word "Supply" is no longer accurately descriptive of the major business operations of this company, the stockholders have voted to drop it from the corporate name.

There has been no change in management, ownership or business at Midwest . . . and none is contemplated. Only the name has been changed. Midwest continues all its activities in the fabrication and installation of piping, and in the manufacture of welding fittings.

MIDWEST PIPING COMPANY, INC.

Executive Offices: 1450 South Second St., St. Louis 4, Mo.

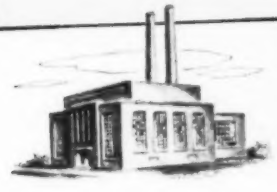
Plants: ST. LOUIS, PASSAIC, LOS ANGELES and BOSTON

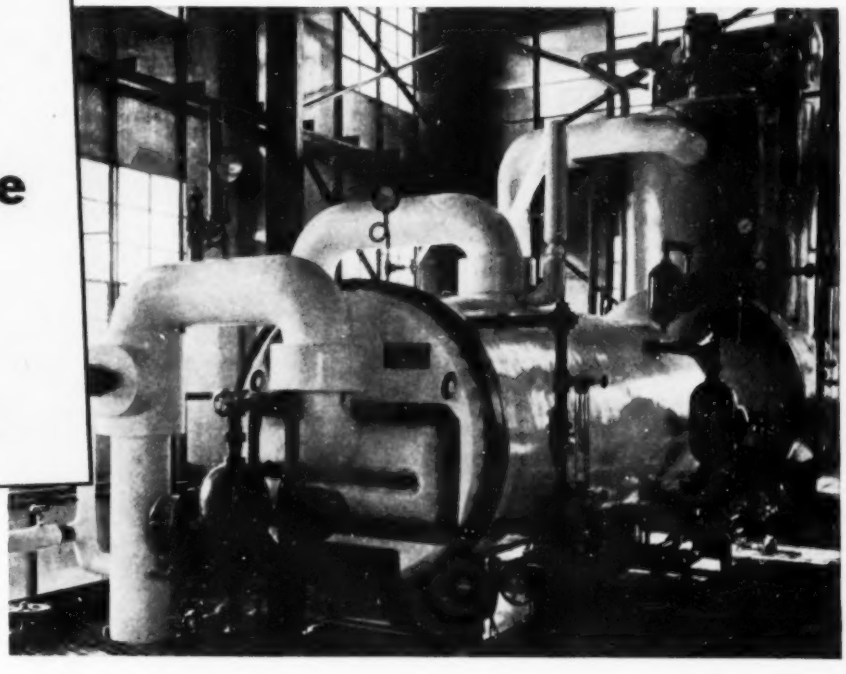
Sales Offices: NEW YORK 7—50 CHURCH ST. • TULSA 3—224 WRIGHT BLDG. CHICAGO 3—79 WEST MONROE ST. • LOS ANGELES 33—520 ANDERSON ST. HOUSTON 2—1213 CAPITOL AVE. • BOSTON 27—426 FIRST ST.

PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS
MANUFACTURERS OF WELDING FITTINGS FOR MORE THAN 20 YEARS

Important!

if you have a moderate size boiler plant





Evaporators for eliminating the impurities from boiler feed make-up were originally developed for large power generating stations.

However, the results obtained with G-R Type R Horizontal and Type H Vertical Bentube Evaporators in industrial plants all over the country have proved that *moderate size plants* can also frequently profit by the many benefits of distilling the raw water supply.

This is a possibility well worth your investigation. Boiler feed purification by G-R Evaporators does not involve the use of chemicals nor require periodical water tests or manipulation by skilled operators. Moreover, it is the simplest method of eliminating raw water impurities.

Write for complete information.

THE GRISCOM-RUSSELL CO.
MASSILLON, OHIO

G-R Type R and Type H Evaporators are adaptations of the larger Type J-2 Bentube Evaporator—widely used by central power generating stations. They embody the exclusive scale-shedding G-R Bentube heating elements, and have many additional distinctive G-R features that assure ample capacity, pure dry vapor, long service, low maintenance expense and convenient attendance.

GR302

G-R HEAT TRANSFER APPARATUS **Bentube Evaporators**

(To obtain more data on advertised products see page 600)

More and More Leading Engineers are Now Recommending

UNIBESTOS®

PIPE INSULATION

WITH ITS SUPERIOR STRUCTURAL VALUES

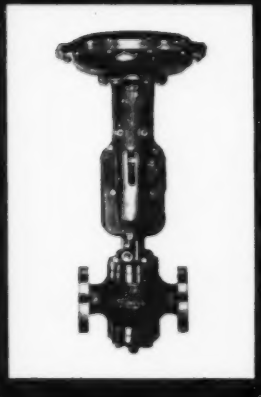
(For 3¢ you can get the whole story)

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. N-4, 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS

• for safe, easy stem lubrication



The isolating valve in the stem lubricator of the Honeywell Series 700 Valve affords maximum safety against leakage when replenishing stem lubricant . . . tight-fitting conical plug and machined seat assure leakless shut-off . . . pinned bonnet prevents accidental removal. The Honeywell Series 700 wide band proportional valve comes in a full range of styles and sizes . . . has *all* the features you look for in a fine valve. Write today for your copy of Bulletin 700-2.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1910 Windrim Avenue, Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
VALVE PRODUCTS

H HONEYWELL

First in Controls

for greater efficiency . . .

INTALOX

SADDLE PACKING

INTALOX — the uniquely different "saddle" tower packing — gives higher flow capacities, lower costs, and greater efficiency in virtually any type of diffusional operation.

INTALOX packs with greater randomness than any tower packing available. Its non-symmetrical design is such that no two pieces can fit exactly one into the other. Thus there is no "nesting", minimum possibility of blocked flow, complete freedom from pronounced channeling.

The elimination of pattern packing not only means more free space, but a greater surface area accessible to liquor and gas.

Early tests which indicated Intalox had a 30%-35% lower pressure drop and 15%-20% higher flooding limit than Berl saddles are being repeatedly substantiated by users' reports. In comparative studies with Raschig Rings, Intalox is showing a pressure drop 60%-65% lower; flooding limits 30%-40% higher.

Intalox is establishing definite savings on operational costs; reducing blower and pumping equipment requirements; reflecting increasing indications that substantial savings in construction costs through reduction in tower sizes are definitely practical.

Intalox is currently available in ½", ¾", 1" and 1½" sizes in either white chemical porcelain or chemical stoneware.

A request to Process Equipment Division, The U. S. Stoneware Co., Akron 9, Ohio, will bring samples and technical data quickly.

INTALOX
features:

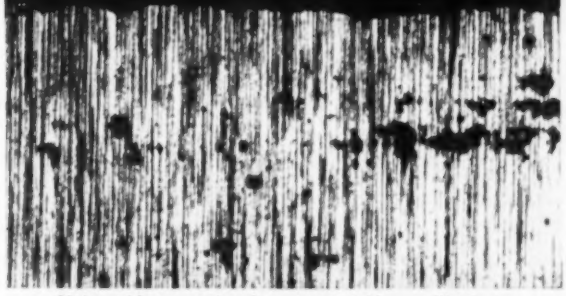
- Greater Surface Area
- More Accessible Surfaces
- Greater Free Space
- Lower Pressure Drop
- Higher Flooding Limits
- Low Side Thrust
- Low Weight
- High Strength

U. S. STONEWARE

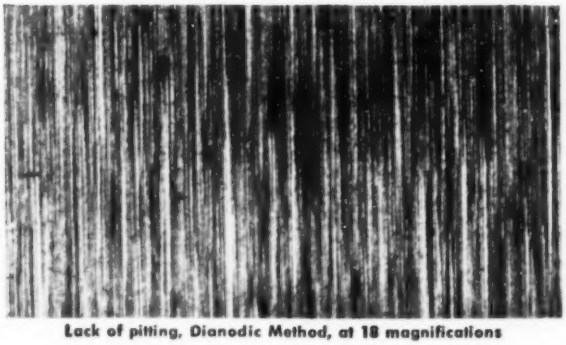
AKRON 9, OHIO

MANUFACTURERS AND FABRICATORS
OF CORROSION RESISTANT MATERIALS
SINCE 1865

HERE'S *Positive Control* OF PITTING AND TUBERCULATION



Pitting with conventional treatment at 18 magnifications



Lack of pitting, Dianodic Method, at 18 magnifications

A complete report on the Dianodic Method of cooling water treatment. Ask for Technical Paper No. 123.

FOR years, industry has sought a method of chemical treatment that would provide *complete* protection against corrosion, pitting and scale in cooling water systems. Many present day methods for corrosion prevention do effect some decrease in metal loss, but unless excess treatment concentrations are used, localized attack in the form of pitting continues with ultimate metal failure.

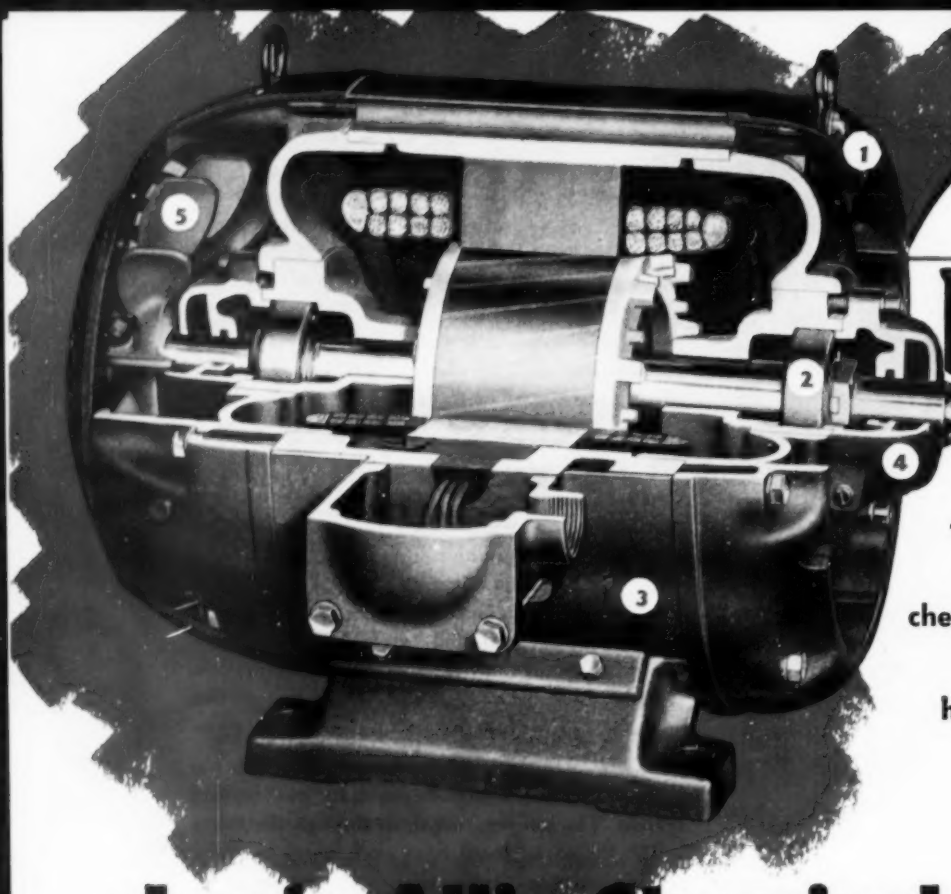
Realizing the importance of this major problem, Betz Laboratories has developed the Dianodic Method, an advanced water treatment technique that assures *complete* protection. In this method, the combination of two anodic inhibitors under correct concentration and pH has proved time and again to control pitting and tuberculation, which conventional treatment is unable to control even at much higher concentrations. What's more, the Dianodic Method provides increased protection against general corrosion.

Here's what happened in one refinery which has a circulation rate of 40,000 gpm on its "cat" cracker system. The temperature drop through the tower is 15° F., with closed heat exchangers used for cooling purposes. Inspection of the system after ten months operation with conventional type treatment revealed freedom from scale and general corrosion, but *serious* pitting and tuberculation. Heads of the exchangers were deeply pitted and tubercles were built up to a height of 3 inches. The edges of the end around baffles were severely pitted and required "filling in" by welding. The Betz Dianodic Method was employed and after ten months the results were outstanding. Not only was scale and corrosion controlled, but pitting and tuberculation were eliminated entirely. The welded baffle ends were in perfect condition with the original welding marks clearly visible!

The development and successful field application of this new method of cooling water conditioning is just one example of the outstanding engineering service offered by BETZ. Why not let a Betz Engineer show how you can improve operating efficiency and cut costs in your plant? Write today. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS



5-way Protection

— protection against volatile vapors . . . chemical fumes, corrosive liquids . . . high humidity . . . salt air

Louis Allis Chemical Motors

A Louis Allis Chemical Motor protects you these five ways against corrosion:

1. Cast-iron construction. Stator housing, end brackets, and conduit box are cast iron, well-known for its resistance to corrosion.

2. Cartridge-type ball bearings. Motor can be completely disassembled without exposing bearings or lubricating grease to dust.

3. Stainless-steel shell over housing. Non-corrosive shell directs air over housing to cool motor. Shell is easily removed, to clean air passages.

4. Removable bearing caps. Let you examine bearings without dismantling motor.

5. Cast-bronze ventilating fan. Keeps motor temperature down, and is non-corrosive.

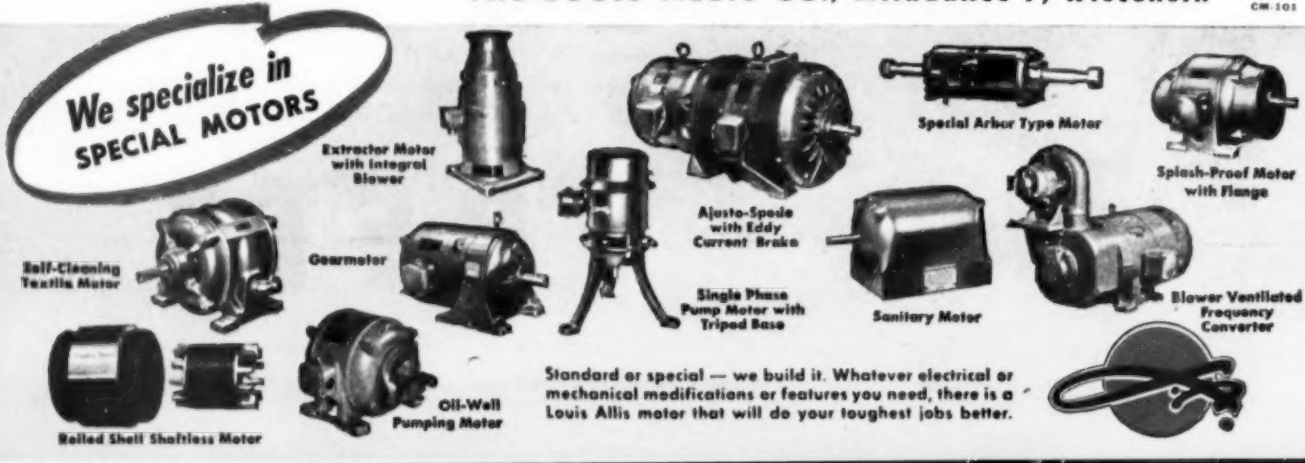
Additional features available include: Special Class A or Class B chemical insulation for extreme corrosive conditions or high ambient temperatures; and drain and breather plugs for elimination of internal condensation due to "breathing."

You can get Louis Allis Chemical Motors in NEMA frames 224 through 505 and frame 108 — in standard, enclosed, fan-cooled construction and enclosed, fan-cooled, explosion-proof construction. They carry Underwriters' approval for Class I, Group D or Class II, Group F or G hazardous locations.

Let the Louis Allis engineer help you solve *your* motor problem and cut your maintenance costs. Call him in soon.

THE LOUIS ALLIS CO., *Milwaukee 7, Wisconsin*

CM-101


We specialize in SPECIAL MOTORS
Extractor Motor with Integral Blower
Special Arbor Type Motor
Splash-Proof Motor with Flange
Ajusto-Speed with Eddy Current Brake
Self-Cleaning Textile Motor
Gearmotor
Single Phase Pump Motor with Tripod Base
Sanitary Motor
Blower Ventilated Frequency Converter
Oil-Well Pumping Motor
Rolled Shell Shaftless Motor
Standard or special — we build it. Whatever electrical or mechanical modifications or features you need, there is a Louis Allis motor that will do your toughest jobs better.

Get

something extra

when you buy

lead valves

Do you look for sturdiness, dependability, and suitability in the lead valves you buy?

Do you expect valve type, size, pattern and flanging to meet your acid handling equipment specifications?

Of course you do! And when you order National you *get* what you look for. You *get* what you expect. And you get certain "extras" besides... extras that spell highest quality.

For example, the lead used is the grade acknowledged best for acid-handling—St. Joe Chemical Lead. Furthermore, National Lead valves have precision, lathe-turned stems. They have full flow-ways. They're designed to permit repacking in service. And they have positive plug-seat fit.

Fabrication extras . . . design extras . . . quality extras . . . Yes! And these extras you get, but never need specify, add up to outstanding service on the job.

That's why it pays to buy National valves . . . for something extra in lead.

New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; New England: National Lead Co. of Mass., Boston 6; Pacific Coast: Morris P. Kirk & Son, Inc., Los Angeles 23, Emeryville 8 (Calif.), Portland 10, Seattle 4; Canada: Canada Metal Co., Ltd., Toronto 8, Montreal, Winnipeg, Vancouver.

Dutch Boy PRODUCTS

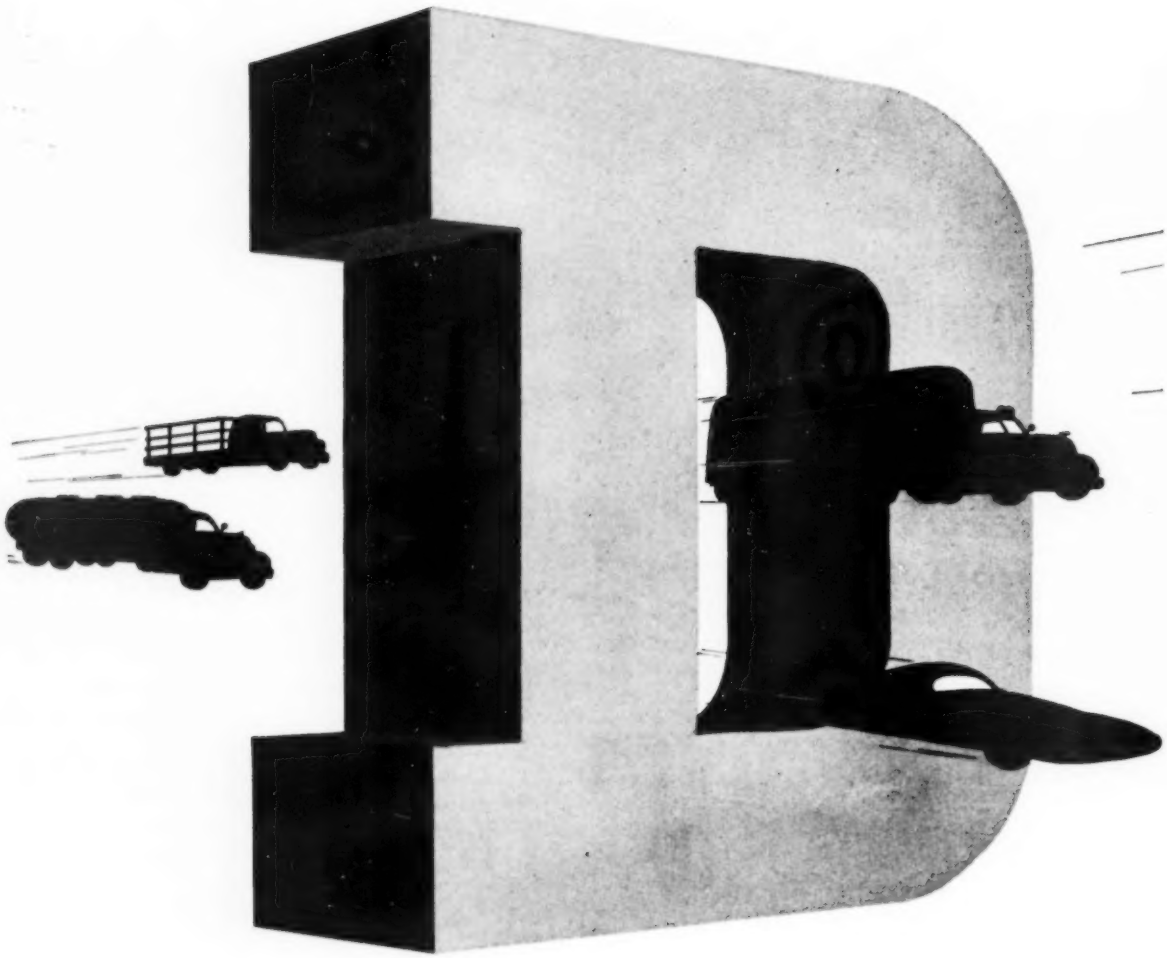
® Reg. U. S. Pat. Off.

Lead valves

with a NATIONAL reputation

LEAD COMPANY

(To obtain more data on advertised products see page 600)



DAVISON DEPENDABLE CATALYSTS BUILD BETTER MOTOR FUEL

The operating efficiency of synthetic fluid-type cracking catalysts is important. This operating efficiency can be assured by uniformity of physical characteristics and chemical purity. Davison's production of microspheroidal (M-S*) is tops in uniformity . . . providing all users with a highly efficient synthetic fluid-type cracking catalyst. Your requirements can also be supplied in ground (DA-1*) form. Write for further descriptive information. Experienced Davison Field Service Engineers backed up with complete laboratory testing facilities are part of Davison's service.

*T.M.T.D.C.C.

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

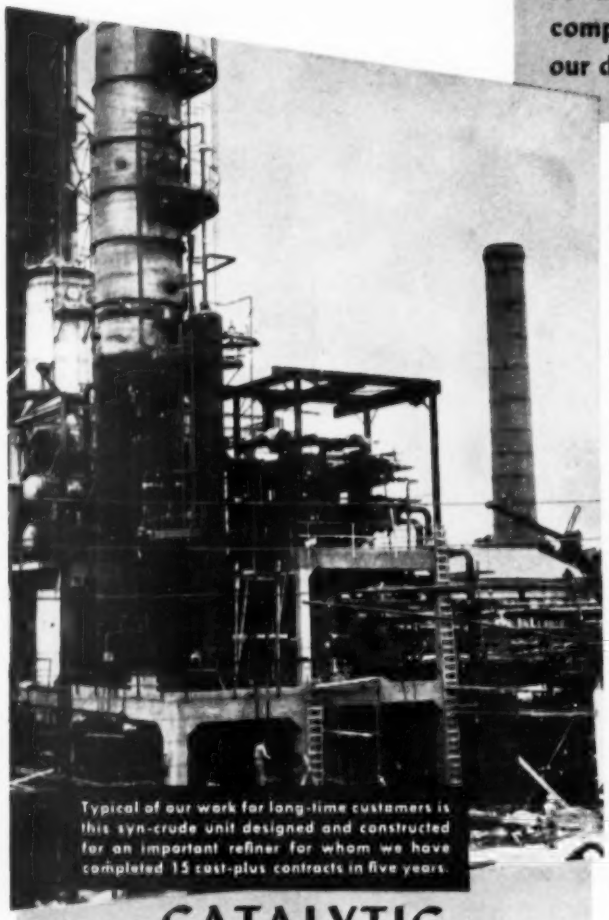
Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

(To obtain more data on advertised products see page 600)

Vote of Confidence

Catalytic on-time on-budget service has earned a vote of confidence from all the blue-chip organizations listed below—repeat orders from most of them. We at Catalytic are proud that so many important petroleum and chemical companies so often recognize our ability and our devotion to their interests.



Typical of our work for long-time customers is this syn-crude unit designed and constructed for an important refiner for whom we have completed 15 cost-plus contracts in five years.

- Alan Wood Steel Company Conshohocken, Pa.
- Albatros S. A. Belge Antwerp, Belgium
- Allied Chemical & Dye Corporation Omaha, Nebraska
- *Argentine Government La Platte, Argentine
- *Ashland Oil & Refining Company Ashland, Kentucky
- *Atomic Energy Commission New York
- *Atomic Energy Commission Oak Ridge, Tennessee
- Atomic Energy Commission Schenectady, N. Y.
- *California Refining Company Perth Amboy, N. J.
- *Canadian Oil Refineries, Ltd. Sarnia, Ontario, Canada
- *Continental Oil Company Ponca City, Oklahoma
- *Crown Central Petroleum Corp. Houston, Texas
- Daikyo Oil Company Yokkaichi, Japan
- *General Electric Company Schenectady, N. Y.
- *Gulf Oil Corporation Pittsburgh, Pennsylvania
- *Houdry Process Corporation Philadelphia, Pa.
- *International Minerals & Chemical Corporation Chicago, Illinois
- *Leonard Refineries, Inc. Alma, Michigan
- Ohio Oil Company Robinson, Illinois
- Pennsylvania Salt Mfg. Company Philadelphia, Pa.
- *Petco Corporation Blue Island, Illinois
- Petrol Terminal Corporation Texas City, Texas
- Polymer Corporation, Ltd. Sarnia, Ontario, Canada
- *Pure Oil Company Chicago, Illinois
- Pusey & Jones Corporation Wilmington, Delaware
- *Rohm and Haas Company Bristol, Pa.
- Shamrock Oil & Gas Corporation Sunray, Texas
- *Sharples Chemicals Inc. Wyandotte, Michigan
- *Shaw-Kendall Company Toledo, Ohio
- *Shell Berre Oil Company Paris, France
- *Sinclair Refining Company Corpus Christi, Texas
- *Socony-Vacuum Oil Company Paulsboro, N. J.
- *Standard Oil Company of Ohio Cleveland, Ohio
- Standard Oil Company of Texas El Paso, Texas
- *Sun Oil Company Philadelphia, Pa.
- Sun Oil Company, Ltd. Sarnia, Ontario, Canada
- *Susquehanna Pipe Line Company Toledo, Ohio
- *Tide Water Associated Oil Company Bayonne, N. J.
- U. S. Bureau of Mines Rifle, Colorado
- U. S. Navy Norfolk, Virginia
- *Union Oil Company Wilmington, California

*Repeat clients

CATALYTIC CONSTRUCTION COMPANY

1528 WALNUT STREET, PHILADELPHIA 2, PENNA.

In Canada: Catalytic Construction of Canada, Limited: Sarnia, Ontario

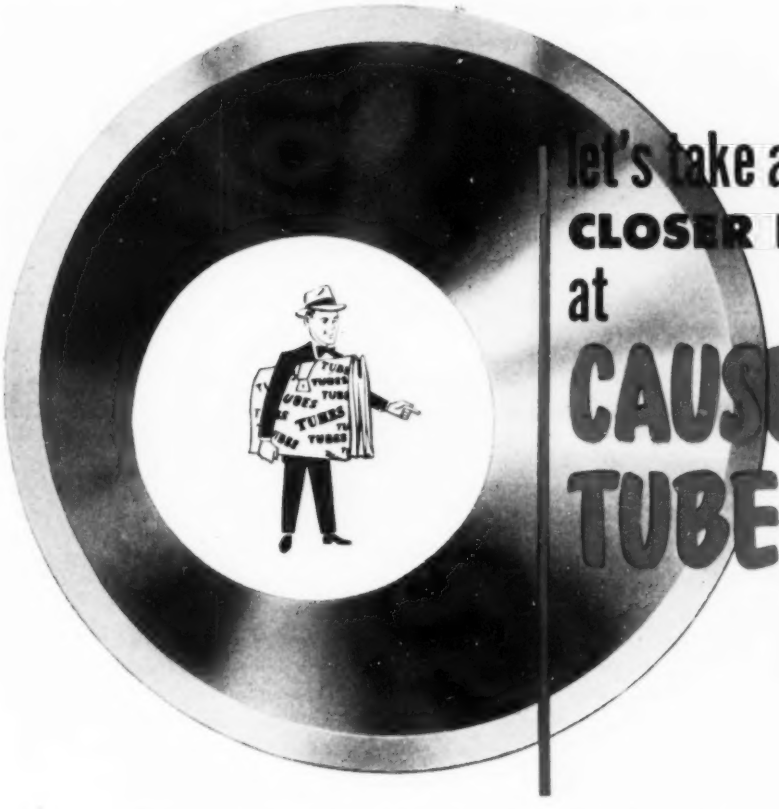
CATALYTIC ON-TIME . . . .

. . . . ON-BUDGET SERVICES

for the chemical, petrochemical and oil refining industries

Project Analysis Engineering Economic Studies

Procurement Process Design Construction Plant Operation



let's take a CLOSER LOOK at CAUSES OF TUBE FAILURES

Tubes are critical materials. Peak production of petroleum products is vital to the defense program. These are two urgent reasons for giving extraordinary attention *now* to getting optimum failure-free service from tube installations in petro-chemical facilities.

Of major importance in securing best operating results is an understanding of the numerous factors affecting tube life in high pressure, high temperature applications. Innumerable investigations of tube failures in such service over a 25-year period show that they are most frequently caused by circumstances other than actual physical defects in the tubes themselves. By far the most common causes of failures are overheating, excessive pressures, corrosion, and scaling due to tubes being subjected to improper operating conditions.

Enumerated are some of the more prevalent reasons, based on extensive studies, that account for excessive tube temperatures and attendant failures in chemical and petroleum conversion equipment. These are presented in the hope they will aid engineers and operating personnel to get better-than-ever service from their tube installations.

Through Mr. Tubes—your local B&W Tube Representative—is available a wealth of data on the behavior of tubing steels under conditions embraced in modern processing plants. It may pay you as it has so many others to call on this vast source of useful information.

Some Common Causes of Reduced Tube Life and Increased Maintenance

1. Excessive transfer rates in furnace equipment.
2. Coking of tubes — either expected or extraordinary.
3. Failure to clean tubes at regularly scheduled periods.
4. Unexpected radiation from bridge wall or refractory surfaces.
5. Improperly calibrated fuel meters on burner equipment.
6. Increase of product temperature over a safe design limit.
7. Unequal heating around circumference or along tube length.
8. Excessive furnace temperatures.
9. Guessing at tube metal temperatures.
10. Increase of pump pressure of maintain through-put.
11. Abuse during mechanical decoking, or scaling during burningout operations.
12. Improper supports resulting in bending or sagging.
13. Lack of control of furnace atmosphere to retard scaling.
14. Corrosion of ends or body of tube or both.
15. Carburization and exfoliation of carburized layer.
16. Abrasion or erosion due to coke in fluid stream.
17. Leaky header seats.

Bulletin TR-516 entitled "Some Experiences in Service", contains more detailed information on this timely subject, and is available upon request.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
General Offices & Plants
Beaver Fall, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

Sales Offices Beaver Falls, Pa. • Boston 16, Mass. • Chicago 3, Ill. • Cleveland 14, Ohio • Denver 4, Colo. • Detroit 26, Mich. • Houston 19, Texas • Los Angeles 17, Cal. • New York 16, N. Y. Philadelphia 2, Pa. • St. Louis 1, Mo. • San Francisco 3, Cal. • Syracuse 2, N. Y. • Toronto, Ontario Tulsa 3, Okla.

B&W STAINLESS and WELDED TUBES

TA 1737(P)

YOU'LL FIND TRECO CATS FROM BORDER TO BORDER

- Hi-Way Refineries, Ltd., Saskatoon, Saskatchewan, Canada
- Farmers Union Central Exchange, Laurel, Montana
- Cooperative Refinery Association, Phillipsburg, Kansas
- National Cooperative Refinery Association, McPherson, Kansas
- Kanotex Refining Company, Arkansas City, Kansas
- El Dorado Refining Company, El Dorado, Kansas
- Midland Cooperative Wholesale, Cushing, Oklahoma
- Cosden Petroleum Corporation, Big Spring, Texas
- McMurrey Refining Company, Tyler, Texas
- Southwestern Oil and Refining Company, Corpus Christi, Texas

After only ten years in business, REFINERY ENGINEERING Company has built cat crackers from border to border—from Canada to Mexico and has seven under construction at this time.

If your company is considering a new cat cracker or other new refining facilities or the revamping of your old plant, it will pay you to confer with Treco at once. A call from you will be appreciated and will receive prompt, courteous attention.

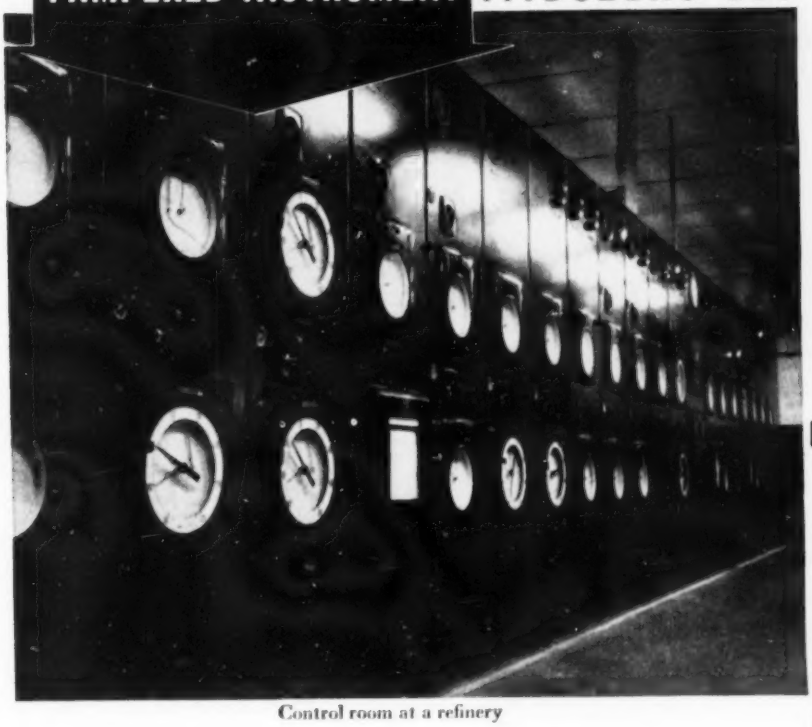
We have just produced a brochure telling the story of Treco and showing many of the jobs we have completed. A copy will be mailed you promptly if requested on your company letterhead.

TRECo

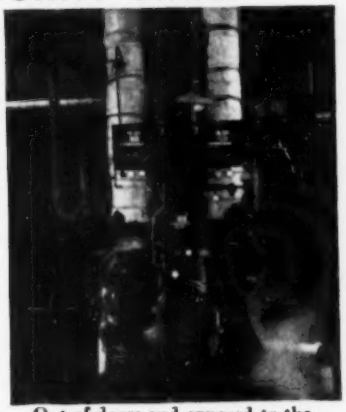
REFINERY ENGINEERING *Company*

PHONE 5-5561 • TULSA, OKLAHOMA

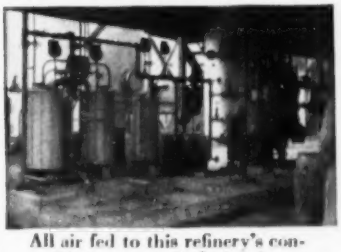
FOR EVERY PAMPERED INSTRUMENT ...DOZENS GET SCANT CARE!



Control room at a refinery



Out-of-doors and exposed to the elements, but dependability is a prime requirement here.



All air fed to this refinery's control instruments is Lectrodryer-DRY and Lectrohilter-CLEAN.

Compensate by feeding them DRY air!

They're building dust-free, air conditioned rooms for control boards in some of the newer plants. But they still have to place many meters, controls and valves out in the weather. Let moisture into the air lines and they're quite likely to have freeze-ups. Mud and rust can form, clogging delicate instrument ports and causing the system to stall.

"Give us Lectrodryers* first to DRY the air", said the instrument men for a prominent oil company in Ohio. Their supervisor had asked if they wanted new instruments or driers. Experience at their Cleveland refinery had shown them the value of feeding DRY air into their control systems.

As you plan new layouts, ask your suppliers to include Lectrodryers in their original bids. Time after time, where driers have been omitted, trouble has developed, making it necessary to add them later at higher cost. Lectrodryer engineers will work with them and you in selecting DRYing equipment for new and old installations.

The book, "Because Moisture Isn't Pink", tells you how many companies have used Lectrodryers for DRYing air, gases and organic liquids. For a free copy, write Pittsburgh Lectrodryer Corporation, 332 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux Liege

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

(To obtain more data on advertised products see page 600)

FOAM FACTS

Published quarterly in the interests of fire protection everywhere.

NATIONAL FOAM SYSTEM, INC.

WEST CHESTER, PENNA.

Portable Foam House Cuts Maintenance Costs, Allows Plant Expansion

A large Southern refinery was recently faced with the need of eliminating the excessive cost of maintaining its main line chemical foam piping system. Also, a more flexible system was wanted, to allow for future expansion.

Portable System Devised

To solve this problem, engineers of National Foam System designed and installed a completely portable "Foam House on Wheels," consisting of two trucks and a trailer. Each truck was equipped with an Aer-O-Foam Liquid Proportioning Pump, a 900-gallon tank for Aer-O-Foam Liquid 3% Regular, nozzles and hose. One truck was equipped with a water pump, the other designed so that a water pump could be added later if desired. The trailer housed a gasoline-driven pump and hose.

Costly Piping Eliminated

Foam house and main line piping were abandoned, and only the lateral piping to foam chambers was retained. All existing chemical foam chambers were converted with the new National MCV foam makers for use with mechanical Aer-O-Foam.

Complete Flexibility

When fire occurs, a truck or trailer is spotted at a point near a water hydrant, the hose is connected and, when water is flowing through the truck, the Aer-O-Foam Liquid Proportioner is adjusted to inject foam liquid at the proper rate. Two flow meters provide a continuous check on the accuracy of the water and Liquid input. When tanks are not equipped with chambers, foam towers are similarly used.

The result is better, more flexible protection, elimination of the costly piping system and foam house, and adaptability to the expansion plans of the refinery.

COMPLETE FOAM FIRE PROTECTION... NO WATER OR POWER SUPPLY NEEDED WITH NEW NATIONAL PRESSURE-PACK

For complete foam fire protection where neither water nor power is available, the new National Pressure-Pack is the ideal answer. Here is a completely self-contained, pressurized, mechanical foam unit, supplied in four standard sizes ranging from 33- to 200-gallon solution capacity. The largest unit can produce 2,000 gallons of fire-smothering Aer-O-Foam in less than three minutes.

The Pressure-Pack is designed for use with overhead spray deflectors, dip tank or drainboard deflectors, floor nozzles or portable nozzles. Installations may be either portable or fixed. Operating pressure is supplied by a nitrogen or air cylinder.

A control for local manual operation is provided. Other available controls include remote manual operation, completely automatic operation, or any combination of these controls. The unit is easy to install and maintain, can be tested at any time without using Aer-O-Foam Liquid, and can be recharged in a matter of minutes after use.

For all isolated hazards, or wherever water and power are not available, the Pressure-Pack supplies the same dependable Aer-O-Foam that is so widely used by the largest refineries and bulk plants. A complete descriptive folder is yours for the asking.

150 Years of Skill

Although National Foam System, Inc., marks the Silver Anniversary of its incorporation this year, its experience goes back almost 150 years, through the days when its predecessor, James Boyd & Bro., was later one of the largest manufacturers of motorized fire-fighting apparatus.

In the late 1920s, National Foam developed the first dual-line dry powder chemical foam system used in this country. In World War II, National helped to save innumerable lives and ships through its development of Aer-O-Foam, the mechanical foam known as "Navy Bean Soup." Again, National helped design equipment for loading jelly gasoline fire bombs.

Today National Foam System still serves the Armed Forces while it expands to meet the growing needs of industry. New products, improved designs, greater variety are combined in National Foam's largest and most versatile line of foam and foam equipment to be found anywhere.

Send for Your Free FOAM FACTS Subscription

FOAM FACTS, a quarterly magazine packed with interesting information on foam fire-fighting, will be mailed to you entirely free upon request. Just send your name and address to National Foam System, Inc., West Chester, Pa. There's no obligation, of course.

The practical way to save pipes, tanks, derricks, buildings, pumps, roofs, fences

STOP RUST! with RUST-OLEUM

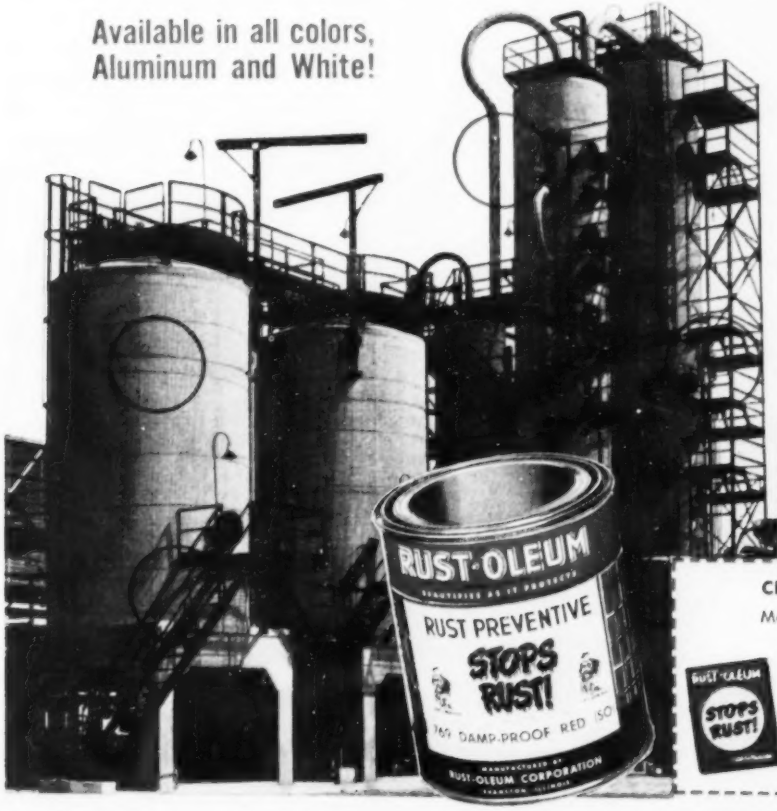
May be applied directly over rusted surfaces without removing all the rust!

RUST-OLEUM is the *practical, sensible* answer to your rust problems. Cuts your maintenance costs, because it may be applied *directly over rusted surfaces* after wirebrushing and scraping with sharp scrapers to remove rust scale and loose particles . . . costly sandblasting and chemical pre-cleaning are not usually required. This often enables *one man* to do the work of two with RUST-OLEUM! Practical, too . . . because RUST-OLEUM beautifies as it protects in *all colors, aluminum,* and *white.*

We'll be happy to show you convincing proof that RUST-OLEUM can cut your maintenance costs . . . and last longer when applied over rusted surfaces. Get the facts, today! Prompt delivery from Industrial Distributor stocks in principal cities in the United States and Canada.

RUST-OLEUM CORPORATION
2477 Oakton Street, Evanston, Illinois

Available in all colors, Aluminum and White!

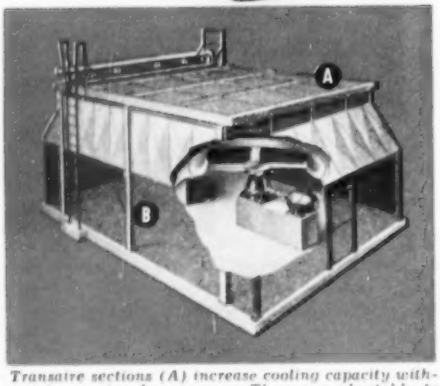


CLIP THIS TO YOUR LETTERHEAD

Mail To: Rust-Oleum Corporation
2477 Oakton Street
Evanston, Illinois

- ☐ Have A Qualified Representative Call
- ☐ Full Details On Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source

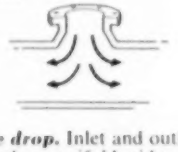
Announcing the NEW improved . . . .



Transaire sections (A) increase cooling capacity without increasing horsepower. They are adaptable to almost any duty involving pressure to 5,000 psi and temperatures to 1,500°F. Fluor steel structures (B) are prefabricated to simplify field erection. Gears and fans in many sizes permit the proper combination for every requirement.

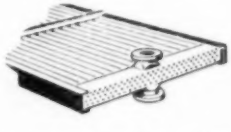
The new Fluor Fin-Fan now comes equipped with *Transaire Sections*, an improved heat transfer surface that holds velocity pressure loss to a minimum, provides smoother flow into and out of tubes, increases the safety factor, reduces operating and maintenance costs and can be assembled and dismantled for cleaning and replacements more easily than any other air-cooled heat exchanger of conventional design.

Fluor structures and mechanical equipment, with a remarkable field performance record since 1940, have been retained. Now for the first time the Fluor Fin-Fan is completely selected and supplied by Fluor. More Fluor Fin-Fans are in operation throughout the world today, and regardless of wind and water conditions, you can depend on Fluor Fin-Fans for dependable cooling service.



Less pressure drop. Inlet and outlet nozzles in the header-manifold widen out below the flange for smoother flow through the section and with less pressure drop. Area of these openings is equal to a full pipe cross-sectional area. Countersunk tube holes inside the header reduce turbulence.

More heat transfer surface. Tubes are helically wrapped with a crimped fin which presents more metal-to-metal contact and more contact to passing air for greater dissipation of heat. Tubes and fins are available in a choice of materials. Single units can be used for multiple duties.



Four-to-one safety factor. Headers are either cast iron or fabricated steel and in either case are *unconditionally guaranteed* to withstand test pressures of four times the design pressure. Brass header plugs provide quick easy access to tube ends for cleaning without requiring special tools.

BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA

FOREIGN: FACTS-FLUOR-PARIS
FLUOR OF CANADA-TORONTO
FLUOR INTERNATIONAL-BEIRUT
HEAD WRIGHTSON-LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA

For complete information on Fluor Fin-Fans write for Bulletin FF-7.

A Typical Report of a GRAVER DEAERATING HEATER

GUARANTEE: *Exceeded*

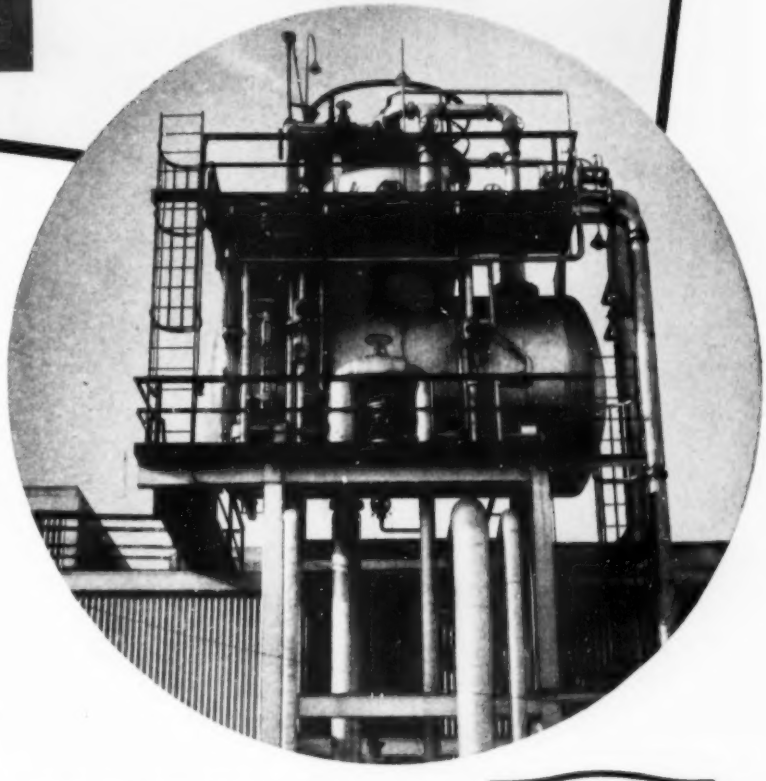
SERVICE: *Excellent*

The installation: A prominent Eastern petroleum refining company.

The unit: Graver Spray-Type Deaerating Heater delivering 450,000 pounds of feedwater per hour to 650 psig waste heat boilers.

The requirements: To remove up to 100 ppm CO_2 and 12 ppm O_2 under all load conditions with water at 60°F. Guarantee - 0.005 ml/l of O_2.

The performance: Average of 0.0047 ml/l of O_2 certified by an independent consulting engineering laboratory, and with completely trouble-free service.



The important point about this report is that it is *typical* of Graver Deaerating Heater performance, even under difficult load variations or water conditions.

Graver Heaters are available in a *complete range* of sizes in spray, tray, or combination spray-tray types. Graver Heaters are individually tailored to your exact plant requirements . . . that's one of the reasons why Graver's guarantee and service can be depended upon.

Write for free copy of "Trends in Application of Deaerating Heaters for Treatment of Boiler Feedwater".

GRAVER WATER CONDITIONING CO. GRAVER

Division of Graver Tank & Mfg. Co., Inc.

Dept. PP-H, 216 WEST 14TH STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd.; Cobourg, Ontario

In Mexico: Provedores Tecnicos, S.A.; Puebla 259, Mexico 7, D. F.

gw4et

(To obtain more data on advertised products see page 600)

dependable

WEDGEPLUG
General Service
STEEL VALVES

night

POSITIVE CAM ACTION

ADJUSTABLE WHILE IN USE

LIFTS, TURNS And RE-SEATS
IN ONE OPERATION

WRENCH OPERATED

HANDWHEEL OPERATED

WORM GEAR OPERATED

dry plug eliminates need for lubrication

and day operation

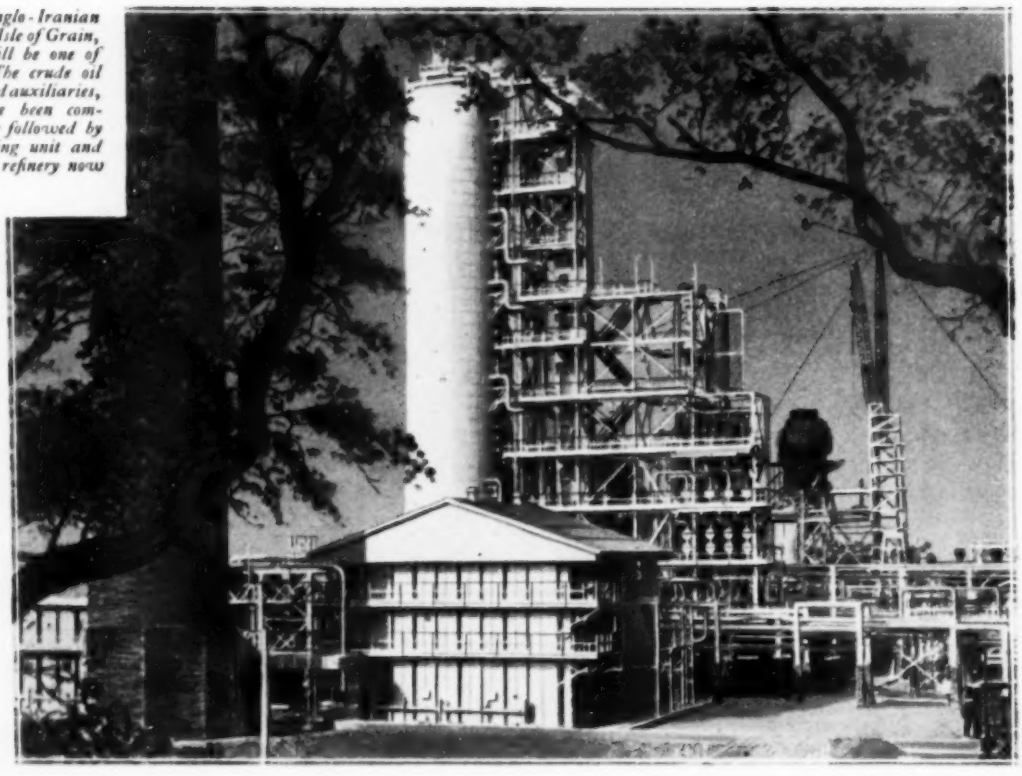
THE proof of the pudding is "in the eating", and the proof of a valve is in its ability to provide satisfactory, trouble-free, low-cost service, day after day, over a long period of time, regardless of temperature or pressure. For quick action, positive operation, ease of adjustment, and low maintenance cost, Wedgeplug General Service Valves can't be beat. Through the scientific, patented application of a simple mechanical principle, the *non-lubricated* Plug of this plug-type valve is lifted quickly from its protected seat; is turned the necessary 90 degrees; then, is lowered and tightly re-seated—all in one operation, with a few turns of the handwheel. The cam action is certain; thus doing away with the problem of "stuck valves". Wedgeplug Valves combine the best features of the Gate Valve and the Plug Valve. They can take the place of standard Gate Valves effectively, yet are priced to compete with conventional-type Plug Valves.

WRITE FOR CATALOG 52-12-W

WEDGEPLUG VALVE CO., INC.
1306 S. BROAD AVENUE, NEW ORLEANS 15, LOUISIANA
An Affiliate of STOCKHAM VALVES & FITTINGS; *Birmingham, Ala.*

(To obtain more data on advertised products see page 600)

Kent Refinery of Anglo-Iranian Oil Company on the Isle of Grain, below London, will be one of Europe's largest. The crude oil distillation plant and auxiliaries, shown here, have been completed and will be followed by the catalytic cracking unit and the lubricating oil refinery now under construction.



PLACING RESPONSIBILITY *to* BEST ADVANTAGE

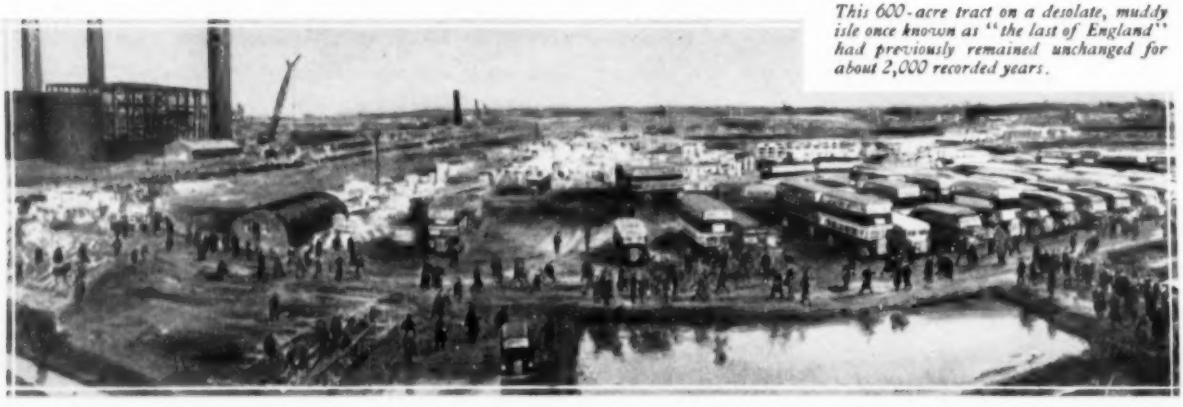
Work of the size and complexity of the new Kent Refinery, incorporating the latest technical developments, requires control and leadership woven together detail by detail.

The Anglo-Iranian Oil Company determined products and processes, then placed the design of certain process units and the overall planning and erection management of the complete refinery in the hands of E. B. Badger & Sons Limited, affiliated with Stone & Webster Engineering Corporation.

The coordination of advance planning, scheduling and construction management on a realistic pattern is a sphere in which the organization has long excelled.

STONE & WEBSTER ENGINEERING CORPORATION
BADGER PROCESS DIVISION

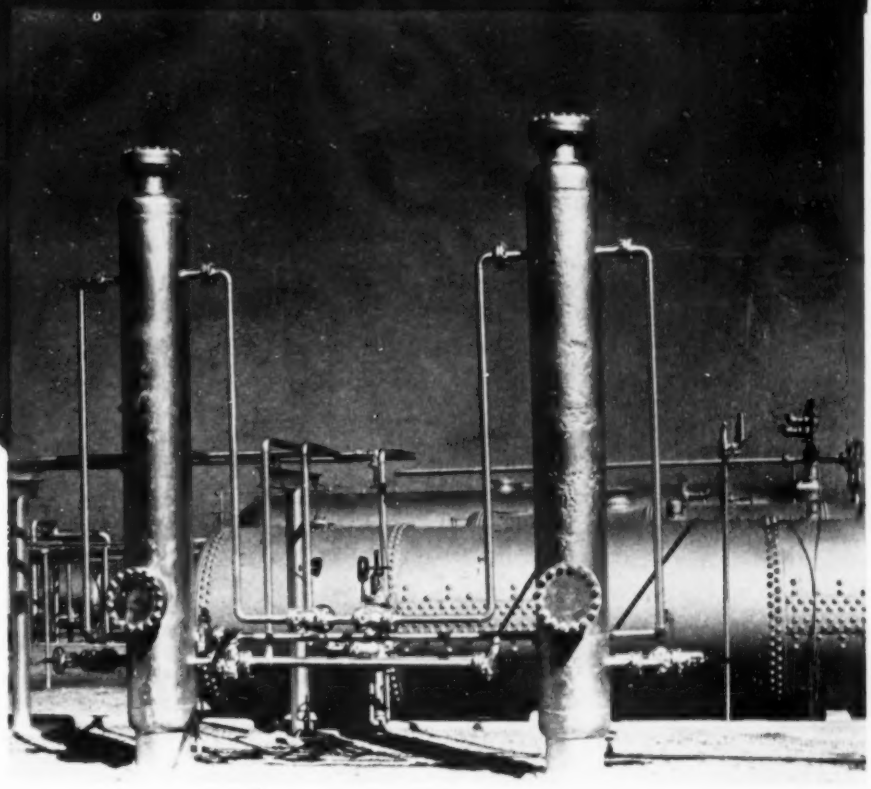
This 600-acre tract on a desolate, muddy isle once known as "the last of England" had previously remained unchanged for about 2,000 recorded years.



Skelly Oil Co. dries

60,000 gallons of liquid propane daily

***with* ALCOA *Activated* Alumina**



Dehydrating towers, Skelly Oil Company, Schafer Plant, Skellytown, Texas. Capacity: 90,000 gallons liquid propane per day at 225 pounds. Desiccant: ALCOA Activated Alumina, grade F-3. Effluent dew point: *minus* 50° F.

Here again is proof of the wide acceptance ALCOA Activated Alumina finds throughout the petroleum industry. For years this steady, reliable desiccant has been drying liquids, gases, air and gaseous hydrocarbons to *lower* dew points than any other commercial adsorbent.

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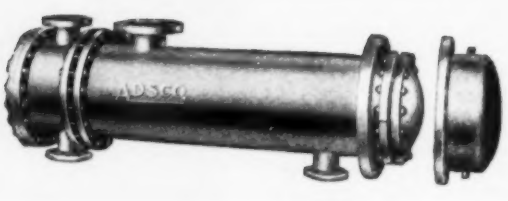

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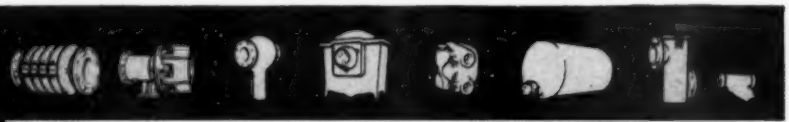

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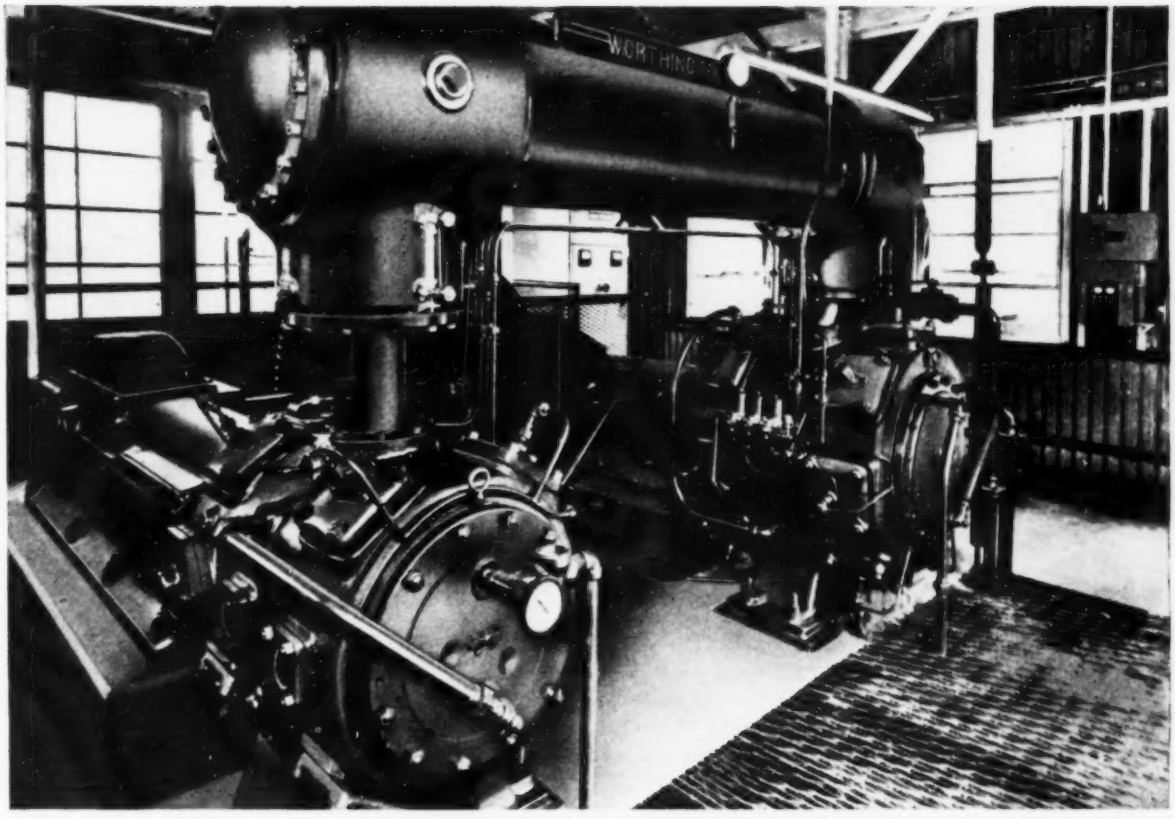

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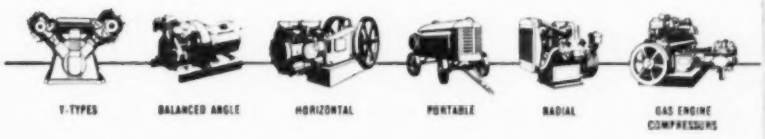

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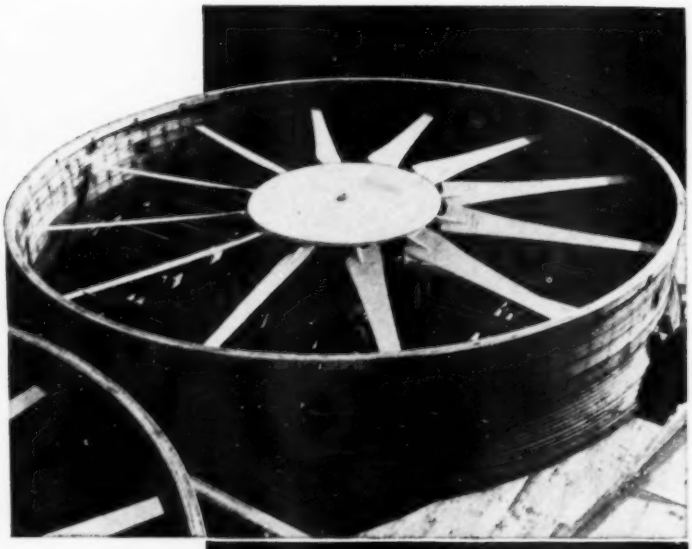

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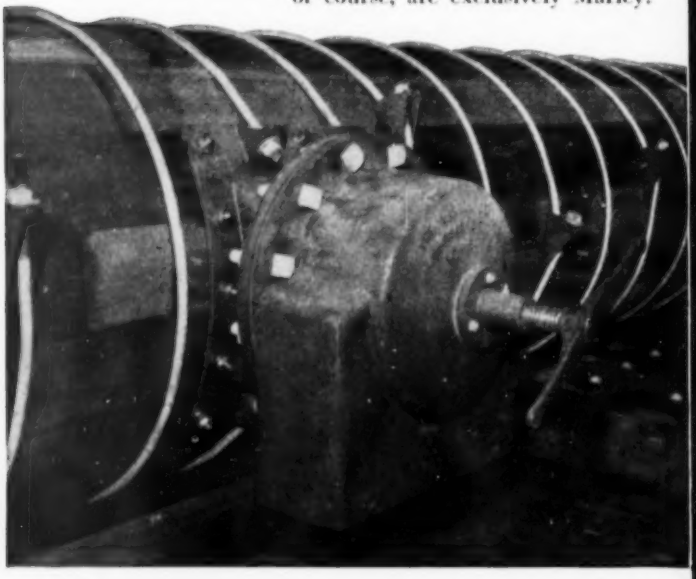

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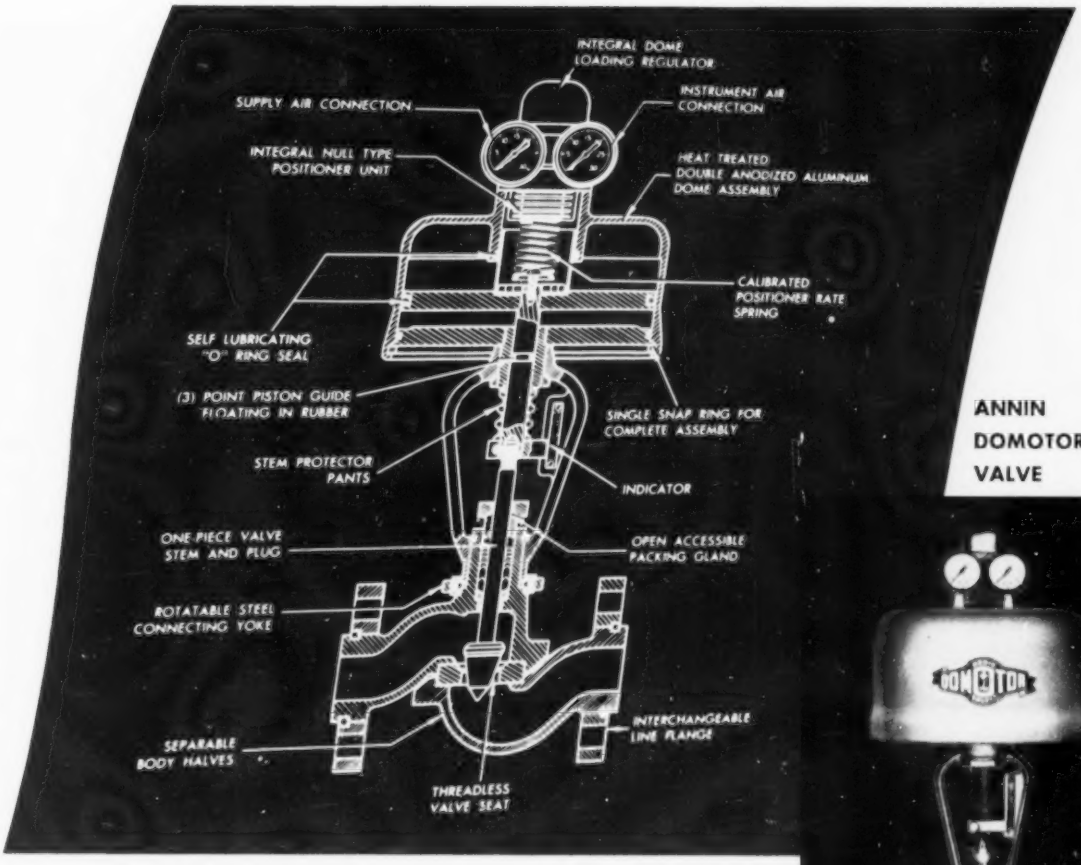
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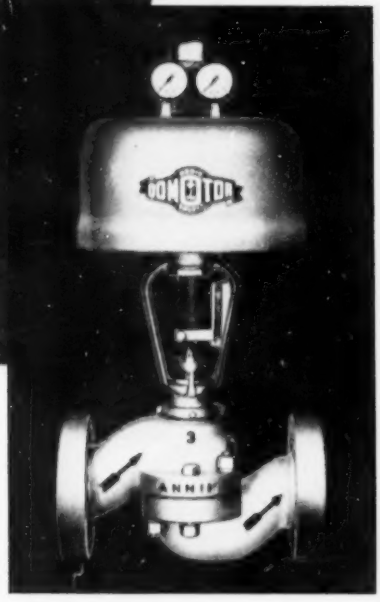

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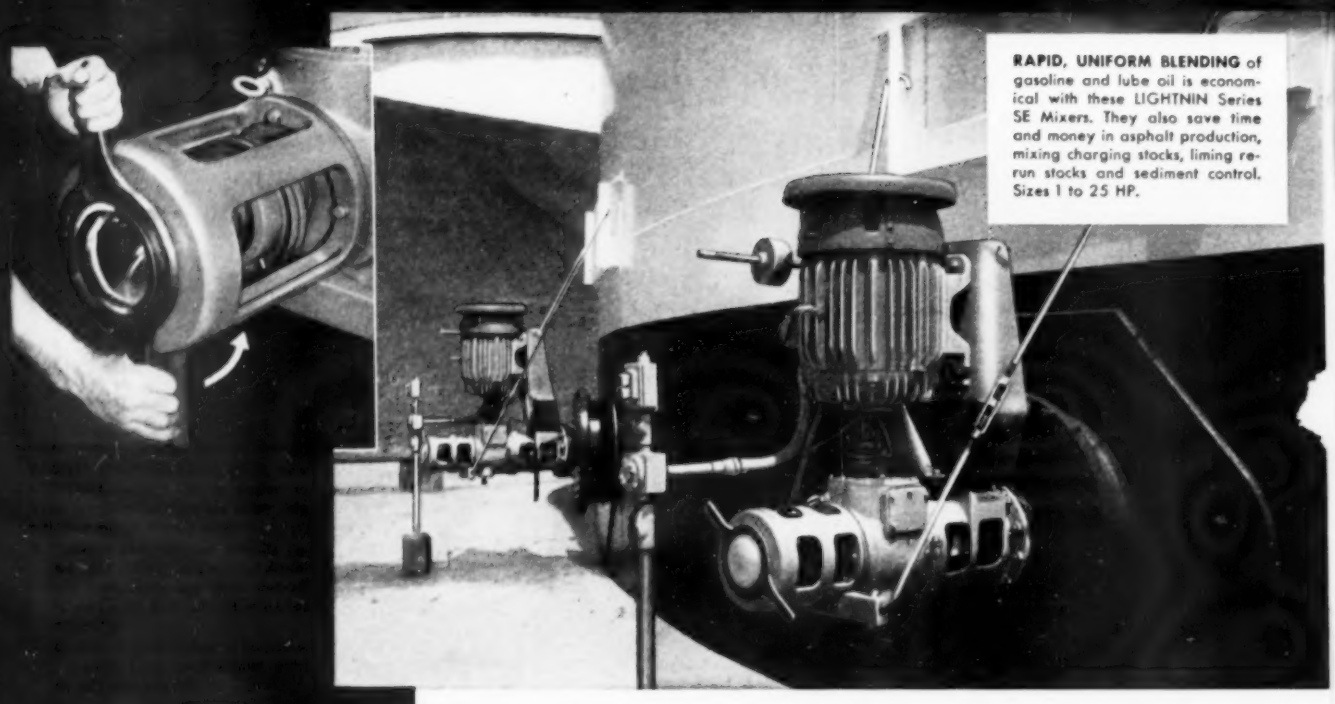

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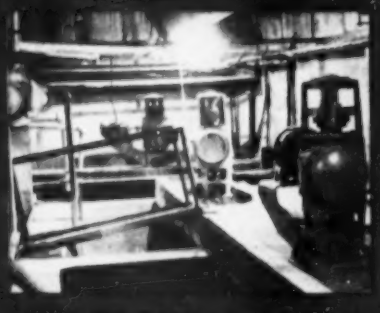

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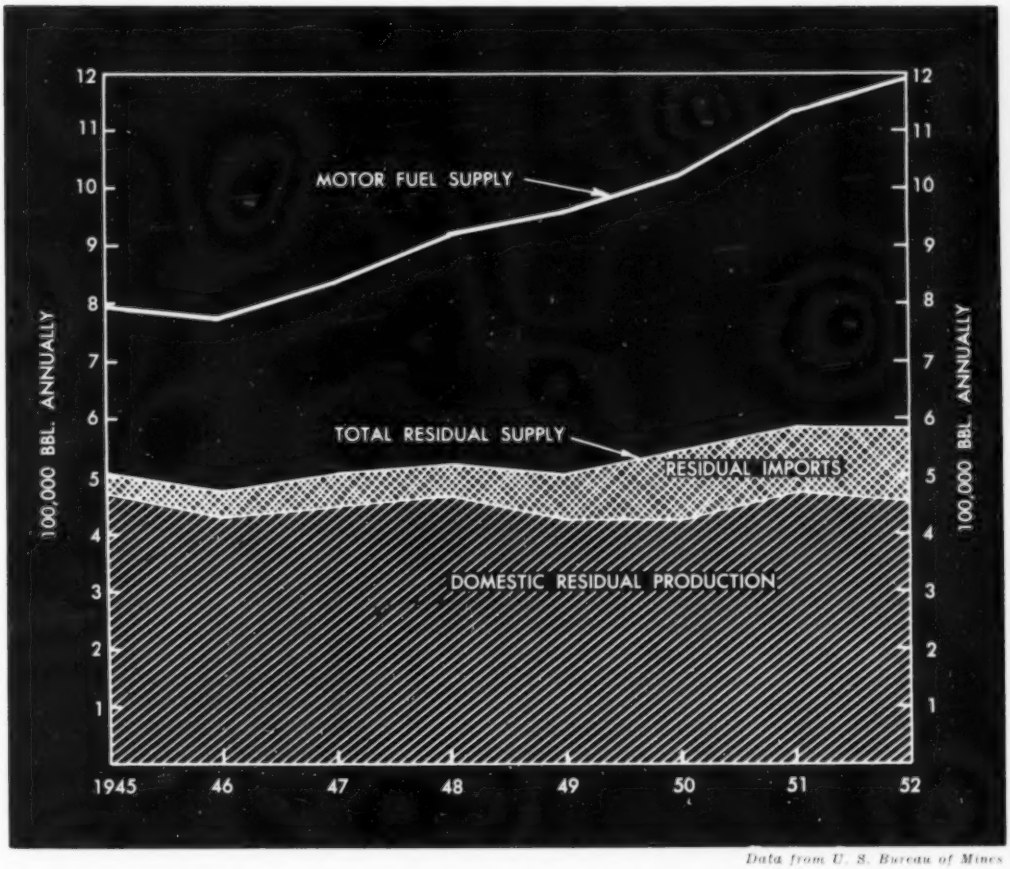


Data from U. S. Bureau of Mines

THE WIDENING GAP between motor fuel supply and refinery output of heavy fuel oil gives some inkling of . . .

Where "Residuals" Are Heading

A Staff Report by the Editors of PETROLEUM PROCESSING

CONTRARY to the present state of affairs, there are factors working toward the long-range improvement of residual fuel oils, the by-product of U. S. refiners.

These factors are brought out in the recent report of the National Petroleum Council to the Petroleum Administration for Defense at Washington on Bunker "C" fuel oil, covering the period 1946-51, PETROLEUM PROCESSING staff writers have since interviewed fuel oil marketers and other authorities in the east for their views on how these conditions will influence the heavy fuel oil markets in the years ahead.

The trends expected to contribute toward greater stability for this product, unless some emergency greatly affects the national economy are:

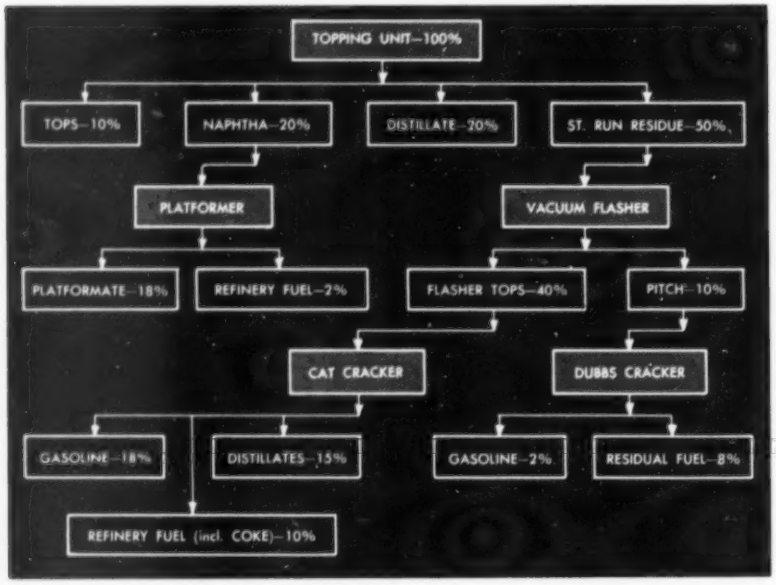
1—Continued shaving down of the refinery yields of residual fuels from crude run to stills, which may within five years reduce the national average from the present 18.6% to 15%.

2—Leveling off of the decline in heavy fuel oil consumption by the railroads, due to the present extent of Dieselization of their rolling motive power. Loss of this fuel oil business from 1946-51 cost the oil companies, mostly the interior refiners, an average of 9,000,000 bbls. a year. Within five years this loss is expected to drop to around 3,000,000 bbls. annually.

A newer, but important, factor foreseen is a decrease rather than an increase in the competition of natural gas with residual fuel oil as an energy source, in the industrial areas of the Eastern seaboard and New England and other areas distant from the gas producing fields.

The trend toward higher prices for gas at the wellhead, and higher gas line transmission costs, will limit the distance from the producing fields where natural gas can economically compete with heavy fuel oils. Gas engineers generalize that they do not now consider gas at the end of 1000-mile lines as competitive with residual fuel oils for general industrial business.

The most uncertain element in a consideration of future markets has to do with residual fuel oil imports. Drastic limiting of imports would not prove sound for U. S. refiners gener-



ONE WAY TO CUT FUEL OIL YIELD is shown in this plan for a process sequence by which a middle western refinery expects to reduce yield to 8% of crude

ally, it is pointed out, if the result were prices that took domestic residual oils out of the competitive market with natural gas and coal as a source of energy.

So far as refinery technologists can see for the immediate years ahead, no major changes in processing methods are in the making which would radically change the volume of heavy fuel oils produced from the crude run to stills. The gradually declining yield of residual fuel will come from more installations of the conventional processes, vacuum flashing, viscosity breaking, and catalytic cracking.

Nor are developments foreseen in new power or heating equipment which will in the next few years create new markets for the residual fuels. Attention is being paid to gas turbines for powering locomotives which can burn the heavy fuel oils, though not as far down the scale as No. 6 or Bunker "C". Fuel development work is being done by at least two oil companies and by the Union Pacific railroad, which has purchased 20 gas turbines for locomotives. There are problems in eliminating the sodium, vanadium and other contaminants in residual type fuels which would be necessary for this use. The fuel problem as the gas turbine builders see it was defined recently by a Westinghouse Electric Corp. engineer before the American Institute of Electrical Engineers:

"If the long range prices of liquid fuels increase as many expect they will, the urge for lower fuel costs will become more pronounced, creating a more intensified effort to produce satisfactory prime movers for operation on the lower grade fuels".

The National Petroleum Council's report on Bunker "C" Fuel Oil was prepared by a special committee, of which B. Brewster Jennings, president of Socony-Vacuum Oil Co., Inc., was chairman. The report summarizes trends in domestic manufacturing, importation and individual types of usage, starting with 1946. It is probably the most comprehensive study of the subject yet made public.

The report recognizes that, basically, residual fuel oil will remain a by-product of petroleum refining operations. Also that the price the refiner can get for it is not of his own making but depends mostly on the cost to consumers of the competitive fuels, coal and natural gas.

In the following paragraphs some of the data from the NPC report on trends in the production and utilization of residual fuel is presented. Included are the views of authorities with oil companies in the east and others as to the influence of these trends on future supply and demand.

Bunker "C" Production

Production of residual fuel oils in U.S. refineries in 1951 was 469,390,000 bbls., a gain of 5.5% since 1946. Imports in 1951 were 118,625,000 bbls., an increase of nearly 165% over 1946. Total supply of residual fuel in 1951, about 588,015,000 bbls., was 20% larger than in 1946. (See Table 1.) In the same period the refinery production of gasoline increased nearly 47%.

In spite of the relatively small increase in the refinery production of residual fuel oil, 1946-51, as compared with other products, realization for this product declined. The average U.S. price in 1951 was 72.5% of the price of crude oil, as against 96.4% in 1946. The price in 1951 was 42.4% of the refinery value of all products except residual, compared with 52.2% in 1946.

The oil companies believe there will not be much change in refinery production of residuals in the years ahead, and that the decline in yields from crude will about offset the increase in volume of crude run to stills. Actual refinery production in 1952, 454,784,000 bbls., was 3.2% less than 1951 production, while about 3% more crude was processed.

Refinery Yields

The yields on crude of residual fuels, 1946-51, varied greatly by the various PAD refining districts, as shown in Table 2, but the extent of decreases during the period were about the same. For the U.S. the drop was from 25.4% to 19.7%.

In the smaller area refining districts reported by the U.S. Bureau of Mines, there is wider variation in residual fuel yields, also in the extent of decreases. In the Okla.-Kans.-Mo. district, where the railroads formerly bought large volume of Bunker "C" fuel, refinery yields dropped from 16.9% in 1946 to 10.9% in the latter part of 1952. In Texas inland refineries, also formerly serving the railroads, yields dropped from 25.5% in 1946 to 14.0% in 1952. Inland refineries in Louisiana and Arkansas had cut their yield from 23.1% in 1946 to 7.9% in latter 1952.

The continuation of the trend to reduce the yields of heavy fuel through 1952 resulted in an overall yield of 18.6%, compared with 19.4% in 1951. One company forecasts an average drop of 0.9% in yield per year over five years; another company believes the national yield will be down to 10% by 1962.

On the effect of processes on product yields, the NPC report states: "The refining processes developed in recent years have been aimed quality-wise toward upgrading of products and quantity-wise toward the reduction of residual fuel oil yields. The reason is obvious . . . in 1946 residual fuel oil sold at 96.4% of the price of crude at the wellhead and in 1951 at 72.5% of the price of crude. The refining processes primarily responsible for the reduction of residual fuel oil yield are catalytic cracking and coking".

The accompanying flowchart shows the processing sequence by which a middle western refinery plans to reduce its heavy fuel oil yield to 8% of the crude processed, through vacu-

um flashing, catalytic cracking and mild viscosity breaking in a Dubbs thermal cracking unit.

Summarized, the yields from this operation are: gasoline, 48%; distillate (inc. kerosine), 35%; residual fuels, 8%; refinery fuel, 12%; total, 103%; with a gain of 3%.

A minor contributing factor to the decline in yields of residual fuel oil, presented in the NPC report, is the upward trend in the average gravity of the crude stream available to refiners. (See Table 3.) This trend is expected to continue.

"The average gravity of crude oil produced in the U.S. increased from 34.0 degrees to 34.7 between 1946 and 1951," states the report. "California and the balance of the country each increased the gravity of production by half a degree. Imported crudes in 1951 averaged 29.6 degrees, or 2.8 above the 1946 average. Weighting the domestic production and imports, it is indicated that the average gravity of the crude oil stream to refineries increased 0.6 degrees, between 1946 and 1951, to an average of 34.3 degrees".

Product Demand

What the loss of sales of residual fuel to the railroads, as Diesel power was installed, has meant to the oil companies is shown in Table 4. Consumption dropped from around 100,000,000 bbls. in 1946 to a little over 55,000,000 bbls. in 1951, an average loss of 9,000,000 bbls. a year. Total domestic consumption increased only 17.4% in the 1946-51 period. Excluding the railroad business, total domestic consumption gained nearly 34% for the period. Railroad consumption of Bunker "C" fuel dropped further in 1952, to about 41,000,000 bbls.

A considerable shift in the relative importance of broad types of consumers from a volume standpoint occurred between 1946 and 1951. In the first postwar year, railroads were the largest consumers of residual fuel oil, followed closely by the group "smelting, mining and manufacturing". Shipping was a close third. These three categories then accounted for almost 60% of all domestic consumption.

By 1951, the smelting and mining group had moved into first place, with ships' bunkers the next largest use, while heating purposes had climbed from sixth to third position. These three uses in 1951 accounted for nearly 60% of total consumption. Railroads had dropped to fifth position.

Rapid Dieselization of the railroads took place in the 1946-51 period. Railroad engineers estimate that by 1952, 75% of their passenger movement, 78% of switching, and 65% of their freight business, was by Diesels. From this point on, further use of Diesel power will proceed more slowly. The oil companies have already taken their largest loss from this class of business.

Competition of Gas

The importance of the factor of natural gas pipeline transmission costs, in limiting the area of competition of gas with heavy fuel oil for industrial sales, is shown in Table 5, where values for gas are given in terms of Btu equivalent to a barrel of Bunker "C" fuel oil. The figures are for 1949 but even then, in terms of heat values, natural gas was more costly than fuel oil to industrial consumers in the seaboard states of New York, Pennsylvania, and Maryland and Virginia. Gas prices have gone up since 1949 and heavy fuel oil prices have declined.

Engineers with the American Gas Assn. say they do not consider that natural gas basically is competitive with fuel oil at the end of 1000-mile transmission lines. They say the cost for transporting gas is about five times that for liquid petroleum under comparable conditions.

The 1000-mile competitive limit for gas does not hold true in all cases

Table 1—Annual Supply of Residual Fuel

(From NPC Report)
(1000 Bbls)

Year	Refinery Production	Imports	Total*
1946	444,935	44,530	489,465
1947	463,185	54,385	517,570
1948	478,826	53,436	532,262
1949	424,860	75,190	500,050
1950	425,225	120,085	545,310
1951	469,390	118,625	588,015

* Adjusted for transfers and net receipts(shipments)

Table 2—Percent Yield of Residual Fuel Oil

	Districts I & III	Districts II & IV	Districts I - IV	Districts V	Total U.S.
1946	22.6	19.4	21.6	44.0*	25.4*
1947	22.6	19.1	21.4	40.6*	24.7*
1948	21.1	18.0	20.1	41.6	23.5
1949	19.2	16.5	18.3	39.1	21.7
1950	18.3	15.3	17.2	37.1	20.3
1951	17.4	15.0	16.5	38.1	19.7
Change 1946-51	—5.2	—4.4	—5.1	—5.9	—5.7

* Adjusted for transfers of crude in California

Table 3—Average Gravity of Crude Supply Available to U. S. Refiners 1946-51

	East of Calif.	Calif.	U.S.	Crude Imports	Total Crude Supply
1946	35.8	25.7	34.0	26.8	33.7
1947	35.8	25.8	34.0	26.7	33.6
1948	35.7	25.8	34.0	28.8	33.7
1949	36.1	26.3	34.3	29.3	33.9
1950	36.3	26.6	34.7	29.3	34.3
1951	36.3	26.2	34.7	29.6	34.3

Table 4—Total U. S. Annual Domestic Consumption of Residual Fuel Oils

(Data from NPC Report)
(1000 Bbls.)

	1946	1947	1948	1949	1950	1951	Increase or Decrease 1951 over 1946	% of Increase or Decrease
Railroads	100,302	97,455	89,596.8	63,473.5	60,882	55,042	—45,260	—45.0
Vessels	88,184	101,908	95,745.6	89,352	92,965.5	107,018	+18,834	+21.2
Total Gas and Electric	50,917.5	60,991.5	56,803.2	80,081	93,075	70,518	+19,600.5	+38.5
Gas	(18,578.5)*	(20,914.5)	(22,948.2)	(20,622.5)	(22,046)	(12,629)	(— 5,949.5)	(—32.0)
Electric	(32,339)	(40,077)	(33,855)	(59,458.5)	(71,029)	(57,889)	(+25,550)	(+79)
Smelting, Mining & Mfg.	99,024.5	115,084.5	117,778.8	122,640	148,117	157,278.5	+58,254	+58.7
Steel Industry	(42,340)	(51,465)	(52,338)	(43,800)	(54,750)	(60,225)	(+17,885)	(+42.2)
Cement Industry	(4,015)	(4,745)	(4,758)	(4,745)	(5,110)	(6,205)	(+ 2,190)	(+54.5)
Heating	49,749.5	56,429	58,633.2	60,407.5	72,708	76,139	+26,389.5	+53.0
Military	37,266.5	24,090	24,668.4	22,739.5	28,324	38,033	+ 766.5	+ 2.1
Oil Company (Incl. Crude)	58,035	62,707	56,656.8	51,684	53,253.5	54,056.5	— 3,978.5	— 6.9
Miscellaneous	5,037	6,825.5	6,624.6	4,562.5	4,891	5,292.5	+ 255.5	+ 5.0
Adjustments to agree with total	— 8,504.5	— 7,081	— 5,929.2	+ 1,095	— 401.5	+ 328.5	+ 8,833	+103.8
Total domestic consumption	480,011.5	518,409.5	500,578.2	496,035	553,814.5	563,706	+83,694.5	+ 17.4
Total domestic consumption excl. of Railroads	379,709.5	420,954.5	410,981.4	432,561.5	492,932.5	508,664	+128,954.5	+ 33.9

* Data in parentheses are memo items and are included in subtotals.

Table 5—Values of Natural Gas at Points of Consumption, on Basis of Btu Equivalent to a Barrel of Bunker "C" Fuel Oil*

(Values are for all industrial consumption, including carbon black)
(Data is for 1949 from U. S. Bureau of Mines 1950 Minerals Yearbook)

	Natural Gas Avg. ¢/Mcf	Natural Gas $/Bbl.	Bunker "C" Fuel, $/Bbl. FOB Terminal
Arkansas	8.3	0.49	1.44
California	19.6	1.15	1.90
Illinois	22.8	1.34	3.57
Louisiana	8.0	0.47	1.60
Maryland, Va. & D. C.	77.2	4.52	1.91
Michigan	52.1	3.05	2.63
New York	58.9	3.45	1.87
Ohio	40.2	2.36	3.19
Pennsylvania	36.9	2.16	1.93
Texas	6.5	0.38	1.56
Oklahoma	8.1	0.48	0.93

*Btu content for gas, 1,040 per cu. ft.
Btu content of residual fuel, 145,000 per gal.

today. Some of the newer lines do not yet have the domestic business and preferred commercial business for their line capacity and the balance is going to industrial consumers at a competitive rate with fuel oil. Other lines sell industrial business in the summer months, in the slack period of their domestic heating business.

The gas people believe this type of industrial gas sales at the end of long pipelines will tend to dry up as the gas companies develop more preferred business, and particularly if present experiments in storing gas underground at points of consumption prove feasible. Then gas would not be sold in the off season to industrial consumers or on "interrupted" basis.

If the data in Table 5 show that distance from producing fields sets a geographical limit where natural gas can economically compete with residual fuel oil, it also shows the great competitive advantage that gas enjoys in areas close to the gas wells. In the southwest, natural gas has been much cheaper than residual fuel and is even used as fuel in the refineries themselves. It is the refiners in these areas who suffered earlier in the loss of the fuel oil business of the railroads.

The present upward trend of gas prices both at the wellhead and at points of consumption is expected to continue. The U.S. Bureau of Mines reports the average value of gas at the wellhead in 1951 was 7.3c per Mcf, up from 6.5c in 1950 and the sharpest rise in value yet recorded in one year. The average value at the point of consumption of all natural gas used in the U.S. in 1951 was 29.8c per Mcf. This was an increase of 3.3c over 1950, "caused in part by the large expansion in areas removed from the producing fields where gas has a higher value".

Markets thru '55 Appraised

FURTHER dropping off in the consumption of Bunker "C" fuel oil by the railroads through 1955 as they convert from steam to Diesel power for locomotives—was predicted by Albert J. McIntosh, chief economist, Socony-Vacuum Oil Co., Inc., New York, in a talk before the Western Petroleum Refiners Assn., in San Antonio, March 24.

He estimates 20,805,000 bbls. as the volume the roads will be using in 1955. This is a decline of 34,200,000 bbls. from the 55,005,000 bbls. used in 1951 (See Table 6.) The biggest share of this loss will have taken place by the end of this year. The loss from 1953-55 Mr. McIntosh places at about 5,000,000 bbls. annually. From that point on, authorities generally agree, the Dieselization of the railroads will be at a point where their use of residual fuel oil will drop only a few million barrels annually.

The loss of the railroad business is expected to be felt mostly in the Gulf Coast, interior and West Coast refining districts. Demand from the Gulf Coast district will drop from around 18,488,000 bbls. in 1951 to 5,475,000 bbls. in 1955; in Districts 2 and 4 (the interior refining areas) from 10,950,000 bbls. to 5,110,000 in 1955; in District 5 (the West Coast) from 18,140,000 bbls. in 1951 to an estimated 10,220,000 bbls. in '55.

The total domestic consumption of residual fuel oils by 1955 is estimated at 588,745,000 bbls., less than 5% larger than the actual in 1951. Sales to the gas and electric utilities will increase about 23% and to the smelting, mining and manufacturing group about 9%. This group will be the largest consumer, with an estimate of 170,090,000 bbls. by 1955.

"For residual fuel oils, we expect the East Coast states (District 1) to show a fairly large increase (by 1955), while the other districts are expected to show no significant increase or a slight decrease" stated Mr. McIntosh. "One of the reasons for these differences is the nature of the consumption at the present time. District 1 has practically no sales of heavy fuel oil to railroads and, therefore, could not have any loss from the reduction in that use which may hurt the other districts.

"Another point is that the use of heavy fuel oils in the power industry is important in the East Coast and we look for great increases in that area, whereas some of the other districts use practically no residual fuel oil for that purpose, or as in District 5, the consumption has been almost static."

Mr. McIntosh expressed himself as "fairly optimistic" for the petroleum industry if the expansion of natural gas in the next few years is similar to the upsurge of the past three years. Fuel oil consumption will continue to increase, he believes, but at a lower rate, while the brunt of the stiff competition from gas will be borne by coal.

According to the gas industry's forecasts, he said, there will be some 60% more gas sold to industry in 1955 than there was in 1950, "but for petroleum fuels we think there will be less than 5% additional sold."

Table 6—Estimated U. S. Annual Consumption of Residual Fuel Oils 1951-1955

(1000 Bbls.)

	1951*	Est. 1952**	Est. 1953	Est. 1955
Railroads	55,005.5	40,992	31,025	20,805
Vessels	107,018	110,532	108,405	110,230
Total Gas & Electric	70,554.5	70,272	81,395	86,565
Gas	(12,264)***	(9,516)	(8,760)	(5,110)
Electric	(58,290.5)	(60,756)	(72,635)	(81,395)
Smelting, Mining & Mfg.	157,278.5	155,550	165,345	170,090
Heating	76,139	80,520	91,615	100,740
Military**	38,033	38,430	39,420	39,420
Oil Company (Incl. Crude)	54,056.5	54,534	54,750	55,480
Miscellaneous	5,256	5,124	5,475	5,475
Total domestic consumption	565,341	555,954	577,430	588,745
Total domestic consumption excl. of Railroads	508,335.5	514,962	546,405	567,940

*Approximately the same figures as for 1951 in Table 4.
**Estimates for 1952, 1953 and 1955 based upon 1951.
***Data in parentheses are memo items and are included in subtotals.

Four Viscosity Standards Changed

ADOPTION by the National Bureau of Standards of a new and more precise value for the kinematic viscosity of water has resulted in revisions in four ASTM viscosity standards in use by the petroleum industry.

Committee D-2 on Petroleum Products and Lubricants is preparing these revisions—for establishment on July 1, 1953—in the affected standards: D-445, Method of Test for Kinematic Viscosity; D-446, Conversion of Kinematic Viscosity to Saybolt Universal Viscosity; D-666, Conversion of Kinematic Viscosity to Saybolt Furol Viscosity; and D-567, Method of Calculating Viscosity Index.

The new value is a result of a long-term research program by the NBS.[1] It is 1.002 centipoises at 68° F. Converted, this value is 1.0038 centistokes, comparing to 1.0070 centistokes, the value currently in use. The new values will affect viscosity measurements by reducing all kinematic viscosities 0.318%. Saybolt Universal and Furol viscosities will remain unchanged.

Following is a summary of the facts and changes to be established on July 1, 1953:

1—The kinematic viscosity of water at 68° F. will be 1.0038 centistokes.

2—All kinematic viscosities will be reduced 0.318%.

3—All kinematic viscometers must be restandardized or recalibrated.

4—No changes are required in Saybolt viscometers or viscosities.

5—Present conversion tables, kinematic to Saybolt Universal and Furol viscosities, will become invalidated. Corrected tables will be obtainable from the ASTM headquarters after June 1, 1953.

6—Present basic kinematic viscosity values for computing viscosity indexes are invalidated. Corrected tables will be obtainable from ASTM after June 1, 1953.

In addition to the revised copies of tables for D-446, D-666, and D-567; some booklets and a series of booklets prepared by Standard Oil Development Co. and The Texas Co. showing calculated V.I. from basic kinematic viscosity values will become invalidated on July 1, 1953. Revised editions of these calculated values will be made available by ASTM later in 1953.

Changes required in kinematic viscometers now in use are as follows. Those instruments having C-constants that are not simple numbers; i.e., 0.1, 0.3, 0.5, 1.0, 3.0, etc., need only have their present factors multiplied by 0.99682, or 1.0038/1.0070, to obtain the proper C-constant. However, a more complicated procedure is needed for those instruments having C-constants of simple numbers. As the physical dimensions of each viscometer, capillary diameter, capillary length, effective head, and efflux volume control the value of C, any one or all of the dimensions may be adjusted to correct for the change in viscosity.

Any or all secondary standard oils in use by laboratories must have their values reduced by 0.318%. The Standards Bureau will revise the values of the viscosity standard oils they distribute as of July 1, 1953.

The API standard oils Alpha, Beta, and Gamma will also have their viscosity values revised on the same date. For those who have these standards on hand, received prior to July 1, the values indicated on the labels should be reduced 0.318%.

Considerable, but necessary, time has elapsed since the new viscosity value for water was announced by the NBS in Jan., 1952. A few months later, the Bureau signified its intention of adopting the new value beginning July 1, 1952. ASTM Committee D-2, at its meeting in June, 1952, requested a delay in adoption until July 1 of this year. This delay was granted to provide time for giving proper publicity to the project and an opportunity to study the subject by those concerned.

Research Division VII of Committee D-2 studied the effect of the change and proposed to D-2 that the new value be adopted July 1. That course of action was agreed upon, thus requiring the revision to Method D445-52T.

A number of alternatives might have been used by Committee D-2 to meet the problem of a revised value in the kinematic viscosity of water. One way might have been the "invention" of a new name for the term defined as "centistoke," and continuing to use present viscometers and V.I. calculations. This would have created the problem of differentiating between the old centistoke under a new name and the "new centistoke" created by the new value for water's absolute viscosity. The idea was discarded as being more expedient than it was attractive in ultimate value.

Another method might have been to apply the new water viscosity value in the calibration of kinematic viscometers and to revise the dimensions of the Saybolt viscometers to preserve the established conversion factors between Saybolt and kinematic viscosities. This was attractive to a few authorities who wanted to preserve the existing V.I. tables. However, since both the V.I. tables and the Saybolt instruments are arbitrary standards, this scheme too was discarded.

The final choice was that adopted and described above: recalibrate kinematic viscometers, recalculate V.I. tables, and retain Saybolt viscometers without change.

Work by the NBS on the present revision actually got underway over 20 years ago, at the instigation of the late E. C. Bingham, who had performed the earlier work leading to the establishment in 1912 of an absolute viscosity for water at 68° F. (20° C.) of 0.01005 poise. In the late 1920's, however, absolute viscosity determinations appearing in the literature were in disagreement with that value by as much as ±4 parts in 1000. A new project was started by NBS in 1932, and continued until the present time, except for a six-year interruption during the World War II period.

The determination as described in the NBS research paper, "was made by the method capillary flow. By means of a calibrated injector, various known constant rates of flow were produced in capillaries of measured dimensions, and observations were made of the corresponding pressure drops through the capillaries. The effects of the ends of the capillaries were rendered negligible by the simultaneous treatment of data obtained with pairs of capillaries having essentially the same diameters but different lengths.

"The value found for the viscosity of water (at 20° C.) is 0.010019 poise as compared with 0.01005 poise, which has generally been accepted for the past 30 years. The estimated accuracy of the new determination is ±0.000003 poise."

(1) "Absolute Viscosity of Water at 20° C.," J. F. Swindells, J. R. Coe, Jr., and T. B. Godfrey; *Journal of Research of the N.B.S.*, Vol. 48, No. 1, Jan., 1952. Research Paper 2279.

How to Handle The Viscosity Change

1—Recalibrate or restandardize your kinematic viscometers. (all kinematic viscosities will be reduced 0.318%).

2—Obtain corrected conversion tables and V. I. index tables after June 1 from the American Society for Testing Materials, 1916 Race St., Philadelphia, Penna.

3—Standard viscosity oils distributed by the National Bureau of Standards and the American Petroleum Institute will be revised to the corrected value after July 1, 1953. Values on labels of standards on hand received before July 1 should be reduced 0.318%.

API Division of Refining

- What's on the mid-year meeting program
- What its technical committees are doing

OVER a thousand petroleum processing technologists and executives from all parts of the country are expected to assemble in New York City next month for the 18th mid-year meeting of the American Petroleum Institute's Division of Refining. The meeting will be held at the Hotel Commodore, East 42nd St. and Lexington Ave., Monday through Thursday, May 11-14.

This gathering will mark the first time that API's Refining Division has held a mid-year meeting in New York City. Last year's meeting was in San Francisco, with an all-time high registered attendance of 907.

A total of 40 technical papers are scheduled for the 11 group sessions which will held during the 4-day meeting. In addition, most of the Refining Division's committees and their subcommittees will be meeting. All sessions and meetings will be held at the Commodore.

The traditional Open Dinner Session will be held Wednesday evening in the Century Room of the Commodore, at $10 a person. John W. Newton, vice president of Magnolia Petroleum Co. and also vice president of the API Refining Division, will preside. Guest speaker at the dinner will be Dr. Allan Nevins, professor of history at Columbia University.

An international flavor has been imparted to this year's program, with four of the scheduled papers to be presented by British and Dutch oil men. Two of these papers will describe new processes—Anglo-Iranian's "Autofining" and Shell's "Hydrodesulfurization" processes. A third deals with "The Pumpability of Fuel Oils" and is included in the session on Analytical Research, and the fourth (in the Training session) will discuss "A Philosophy for Developing Employes."

PETROLEUM PROCESSING will again set up and maintain its Registration Directory Board for the convenience of persons attending the meeting.

Group Sessions

ANALYTICAL RESEARCH

Monday, May 11..9:00 a.m., East Ball Room
Presiding: C. E. Headington, Atlantic Refining Co.

Studies in the Analysis of Petroleum Ashes:

(A) A Statistical Study of Semimicro Methods of Analysis of Ashes from Petroleum Stocks. G. V. Dyroff, Esso Laboratories-Research Division, Standard Oil Development Co.

(B) The Analysis of Petroleum Ashes and Deposits by a Spectrochemical Method. John Hansen and C. R. Hodgkins, Esso Laboratories-Research Division, Standard Oil Development Co.

(C) A Comparison of Spectrochemical and Semimicro Methods in the Analysis of Petroleum Ashes. G. V. Dyroff, John Hansen, and C. R. Hodgkins, Esso Laboratories—Research Division, Standard Oil Development Co.

The Use of X-ray Fluorescence in the Analysis of Lubricating Oils for Barium, Calcium, and Zinc. Elwin N. Davis and Robert A. Van Nordstrand, Sinclair Research Laboratories, Inc.

Determination of a Hindered-Phenol 4-Methyl-2,6-di-tert-Butylphenol in Lubricating Oils by Infrared Absorption. Emil Poti, L. L. Gent, R. C. Pomatti, and Harry Levin, The Texas Co.

The Application of Metal Valves and Teflon Packing Glands in Low-Temperature Distillation Apparatus. R. A. Brown and D. J. Skahan, Atlantic Refining Co.

A Direct Spectrographic Method of Analyzing Fuel Oils for Trace Elements. C. W. Key and G. D. Hoggan, Richfield Oil Corp.

The Pumpability of Fuel Oils. F. Gill and R. J. Russell, Anglo-Iranian Oil Co.

DETERIORATION OF METALS

Monday, May 11....9:00 am, West Ball Room
Presiding: E. H. Barlow, Standard Oil Development Co.

Segregated Graphite in Steel. J. J. Kanter, Crane Co.

Graphitization in Petroleum Refining Equipment. R. J. Fiorentino and A. M. Hall, Battelle Memorial Institute.

Alternate Types of Vessel Construction—A Cost Comparison. I. E. Roberg, Chicago Bridge and Iron Co.

ELECTRICAL EQUIPMENT

Monday, May 11....2:00 pm, West Ball Room
Presiding: L. M. Goldsmith, Atlantic Refining Co.

Improved Electric Utility Service to the Oil Refineries. P. H. Weinberg, Philadelphia Electric Co.

Design and Application of Explosion-proof Equipment. R. P. Northup, Crouse-Hinds Co.

ANALYTICAL RESEARCH

Monday, May 11....2:00 pm, East Ball Room
Presiding: G. R. Lake, Union Oil Co. of California.

Safety Minute Man: Toxicological Properties of Laboratory Materials. Allen E. Dooley, The Texas Co.

Statistical Evaluation of the Reproducibility of Testing Between Petroleum Refinery Inspection Laboratories. W. H. White, Imperial Oil Ltd.; and D. S. McArthur, Esso Laboratories-Research Division, Standard Oil Development Co.

How to Evaluate a Test Procedure. D. S. McArthur and E. L. Baideschwieler, Esso Laboratories-Research Division, Standard Oil Development Co.; W. H. White, Imperial Oil Ltd.; and J. S. Anderson, Esso Standard Oil Co.

The Direct Determination of Oxygen in Organic Compounds. W. H. Jones, Esso Standard Oil Co.

Mass Spectrometer Determination of Volatile Contaminants in Water. F. W. Melpolder, C. W. Warfield, and C. E. Headington, Atlantic Refining Co.

Direct Extraction-Pycnometer Method for Oil Content of Refinery Effluents. W. S. Levine, G. S. Mapes and M. J. Roddy, Socony-Vacuum Laboratories.

Methods for Determining Hydrocarbons and Phenols in Refinery Effluent Waters. C. E. Headington, Atlantic Refining Co.

CORROSION

Tuesday, May 12....9:00 am, East Ball Room
Presiding: S. D. Dalton, Socony-Vacuum Oil Co.

The Prevention of Hydrogen Attack on Steel in Refinery Equipment. W. A. Bonner, H. D. Burnham, J. J. Conradi, Shell Oil Co., and P. Skei, Shell Development Co.

Use of Organic Inhibitor for Refinery Corrosion Control. C. C. Hulbert and J. A. Rippetoe, Pure Oil Co.

Basic Economic Factors of Atmospheric Corrosion vs. Protection. Clarence C. Harvey, Ethyl Corp.

Estimation of Corrosivity of Crude Oils. A. E. Harnsberger, Pure Oil Co.; H. A. Cataldi, Standard Oil Co. (Indiana); and R. J. Askevold, Pure Oil Co.

Deterioration of Redwood Cooling Towers. Roy V. Comeaux, Humble Oil and Refining Co.

What You'll Find in This API Section

This special 13-page section is devoted to the API Division of Refining—to give you a better idea of what the Division's technical committees are doing and what you will hear discussed if you attend the mid-year meeting of the Division next month. Here's what you'll find in this section:

Complete Program—both the papers scheduled for each technical session and the various committee meetings are listed on this and the next page.

Committee Projects—detailed stories on specific projects that have been carried out—a set of "Rules of Recommended Practices for Electrical Installations" (p. 527); the training committee's "Recommendations for the Preparation and Publication of Pump Manuals" (p. 529), and the studies of the deterioration of steel at high temperatures (p. 530).

Committee Reports—the annual reports by the seven technical committee chairmen of what their groups are now working on and what they accomplished in 1952. (p. 531).

Analytical Research—A complete set of abstracts of the 12 papers to be presented at the two sessions on analytical research during the mid-year meeting. (p. 536).

ELECTRICAL EQUIPMENT

Tuesday, May 12...10:00 am, West Ball Room
Presiding: L. M. Goldsmith, Atlantic Refining Co.

Maintenance of Switchgear in Petroleum Refineries, H. B. Wortman, Westinghouse Electric Co.

Maintenance of Electric Motors, Frank H. Walker, Jr. and William J. O'Meara, Atlantic Refining Co.

GASOLINE VOLATILITY

Tuesday, May 12...2:00 pm, East Ball Room
Presiding: W. R. Argyle, Sinclair Refining Co.

Cold-Starting and Warm-up Performance of Late-Model Passenger Cars, R. K. Stone, California Research Corp., and K. C. Bier, Ethyl Corp.

Effect of Gasoline Volatility on the Performance of Passenger Cars, C. J. Domke, C. B. Tracy, and H. R. Taliaferro, Standard Oil Co. (Indiana).

A Survey of Vapor Lock in Postwar Automobiles, Robert Best, Southwest Research Institute.

TRAINING

Wednesday, May 13...9:30 am, Main Ball Room
Presiding: G. S. Dunham, Socony-Vacuum Oil Co.

Industry's Problem Children, Gerald Gordon, M.D., E. I. du Pont de Nemours.

Why Should Industry be Concerned with Economic Education? Dr. Robert Burns, University of Chicago.

A Philosophy for Developing Employes, Col. Lindall Urwick, Urwick, Orr and Partners, Ltd., London.

PROCESSES

Wednesday, May 13 2:00 pm, Main Ball Room
Presiding: J. S. Worden, The Texas Co.

The Autofining Process, F. W. B. Porter, Anglo-Iranian Oil Co.

Shell Hydrodesulfurization Process, H. Hoog, Koninklijke-Shell (Royal Dutch Shell) Laboratorium, and H. G. Klinkert and A. Schaafsma, Bataafsche Petroleum Maatschappij.

Thermofor Continuous Percolation, L. P. Evans, K. E. Magin, J. I. Savoca, and H. W. Shea, Socony-Vacuum Research and Development Laboratories.

Houdriforming Economics—Effect of Feed Stock Boiling Range and Reforming Severity, H. D. Noll, T. A. Burtis, and J. C. Dart, Houdry Process Corp.

OPEN DINNER SESSION

Wednesday, May 13...7:00 pm, Century Room
Presiding: John W. Newton, Vice President for Refining (American Petroleum Institute), Magnolia Petroleum Co.

Address: John W. Newton, Vice President for Refining.

Address: Dr. Allan Nevins, Professor of History, Columbia University.

MOTOR FUELS

Thursday, May 14...9:00 am, East Ball Room
Presiding: A. P. Frame, Cities Service Research & Development Co.

Comparison of LPG, Gasoline, and Diesel Fuel in City Bus Operation, F. C. Burk and E. S. Black, Atlantic Refining Co., and Harley Swift, Harrisburg Railway Co.

Preignition in Automotive Engines, J. R. Sabina, J. J. Mikita, and M. H. Campbell, E. I. du Pont de Nemours & Co.

Recycling Exhaust Gases for Suppression of Knock in Internal Combustion Engines, A. E. Miller and S. Suliss, Sinclair Refining Co.

LUBRICATING OILS

Thursday, May 14...2:00 pm, East Ball Room
Presiding: J. C. Geniesse, Atlantic Refining Co.

Field Studies on Gasolines and Motor Oils Under Severe Service Conditions, J. G. McNab, Standard Oil Development Co.

A Broad Look at Engine Oil Testing, G. H. S. Snyder, E. A. Martin, J. F. Socolofsky and L. Raymond, Socony-Vacuum Oil Co.

Performance Characteristics of MIL-2104 Lubricants in Army Heavy-Duty Service, Norman C. Penfold, Southwest Research Institute, and Norman L. Klein, Department of the Army, Office of Chief of Ordnance.

Committee Meetings

SUNDAY, May 10

Subcommittee on Low-Pressure Storage Tanks and Manufacturers' Subcommittee on Low-Pressure Storage Tanks, joint meeting (all day) ..... 9:00 am, Room C

MONDAY, May 11

Committee on Petroleum Products ..... 9:00 am, Room C
Subcommittee on Instruments ..... 9:00 am, Room D
Subcommittee on Mechanical Equipment and Manufacturers' Subcommittee on Centrifugal Pumps, joint meeting (all day) ..... 9:00 am, Room E
Subcommittee on Sampling and Testing (DRW) ..... 9:00 am, Room F
Subcommittee on Electrical Equipment ..... 9:00 am, Room G
Manufacturers' Subcommittee on Safety and Relief Valves ..... 9:00 am, Club Suite
Committee on Training (all day) ..... 9:00 am, Room B
Subcommittee on Oil-Water Separation ..... 9:00 am, South Room
Automotive Research Committee ..... 2:00 pm, Room C
Committee on Disposal of Refinery Wastes Panel Discussion—Sludges and Spent Clays ..... 2:00 pm, South Room

TUESDAY, May 12

Program Committee ..... 9:00 am, Room D
Subcommittee on Waste Gases and Dusts (DRW) ..... 9:00 am, Room F
Committee on Analytical Research (all day) ..... 9:00 am, Room C
Subcommittee of Refinery Inspection Supervisors ..... 2:00 pm, Room B
Subcommittee on Electrical Equipment ..... 2:00 pm, Room D
Subcommittee on Valves..... 2:00 pm, Room G
Subcommittee on Tank Accessories and Cleanouts ..... 2:00 pm, Room F
Subcommittee on Chemical Wastes (DRW) ..... 2:00 pm, Room E
Committee Sponsors ..... 2:00 pm, Club Suite

WEDNESDAY, May 13

Subcommittee on Corrosion...9:00 am, Room B
Subcommittee on Unfired Pressure Vessels ..... 9:00 am, West Ball Room
Subcommittee on Project Selection (DRW) ..... 9:00 am, Room D
Subcommittee on Sludges and Spent Clays (DRW) ..... 9:00 am, Room E
Committee on Analytical Research (all day) ..... 9:00 am, Room C
Smoke and Fumes Committee ..... 10:00 am, Club Suite
Committee on Refinery Equipment ..... 2:00 pm, West Ball Room
Committee on Disposal of Refinery Wastes ..... 2:00 pm, Room B
Manufacturers' Subcommittee on Pump Manuals ..... 2:00 pm, Room D
Advisory Committee..... 3:00 pm, Club Suite

THURSDAY, May 14

Committee on Refinery Equipment ..... 9:00 am, West Ball Room
Committee on Disposal of Refinery Wastes ..... 9:00 am, Room B
General Committee (Luncheon) ..... 12:00 Noon, South Room
General Committee ..1:30 pm, West Ball Room

Electrical Installations in Refineries

Rules of recommended practices is current project of the API Committee on Electrical Equipment

By LESTER M. GOLDSMITH

Thirty-five years ago a petroleum refinery used one kilowatt hour per barrel of crude oil charged. Today it uses upwards of five kilowatt hours per barrel. As a result of this trend, together with today's greatly increased crude throughputs, the total use of electricity in the refining industry has gone up nearly 4,000% since 1918.

The continuing large growth in the use of electric power in petroleum processing plants, together with the fact that the number of electrical engineers in these plants is still very small, induced the American Petroleum Institute Refining Division, some three years ago, to set up the project of preparing Rules of Recommended Practice for Electrical Installations. The actual work was assigned to the Subcommittee on Electrical Equipment of the API Refining Division's Committee on Refinery Equipment.

Our API committee, being mindful of the size of the petroleum industry and conscious of the fact that there are a lot of refineries which do not have electrical engineers or electrical engineering departments, realized there was much to be gained by the establishment of recommendations that can be accepted by the petroleum industry, as well as the manufacturers of equipment, and the engineering contractors who both design and construct refining units. This is a very large job and can only be accomplished by a hard working committee of able, earnest engineers. We believe, probably in a year from now, we will be able to publish our first book of Recommended Practice and then try to establish a revision every couple of years, which is the system that has been followed by the AIEE in its recommended practices for the marine industry.

The API Subcommittee on Elec-

trical Equipment was divided into groups, and work assigned to the various groups as follows:

Heating Devices, Instrument and Alarms, Lighting: These sections of our recommended practices will contain equipment specifications we feel are essential to the petroleum refining industry, particularly from the standpoint of safety. Not all of the subject items are developed to the point where use in a hazardous area does not require additional and separate means of protection. In these cases a guide for safe application will be provided. Here again, proven installation and maintenance practices will be offered in addition to preferred materials and design. It is believed that standardization or some approach to it will accomplish a great deal with this type of equipment where only recently has there been any indication of real progress in meeting the needs of the industry.

Portable Equipment: The use of portable equipment and devices is generally avoided in the refinery for obvious reasons. However, the large scale construction and maintenance operations working on close schedules require the use of such items as electric welders, handling equipment, hand and temporary floodlights, and instruments of various types. The practices to be recommended by the committee governing the use of this portable equipment will include electrical and mechanical requirements for selection and installation of receptacles and cable used with this equipment, and for the most part will supplement existing code requirements. The importance of good maintenance to insure safe conditions in the use of portable equipment is recognized and will also be covered.

Communications and Signals: Because the area containing a refinery is necessarily large and the hazards of fire and explosion present, a dependable trouble-free communications system is vital. The proposed regulations for this utility are presently being worked on and will attempt to point out applicable core requirements, usual definition of responsibilities between the telephone company and refinery, contruction methods and special alarm circuits such as fire protection, etc. Generally preferred types of equipment for various applications will be covered together with sufficient installation and maintenance information to properly guide the designer. Special equipment, such as sound powered systems, will be discussed and recommended for appropriate service.

Overhead Lines: This section, probably the most comprehensive prepared to date, probes into every factor directly associated with the design and installation of overhead lines. Considered by many refineries to be the most satisfactory method of delivering power, control and communications, the overhead lines, though more economical, require more consideration from the standpoint of supports, clearances, insulators, mechanical loading, isolating devices and terminations. These generally approved practices, in addition to covering in detail the running of lines on poles, towers and buildings, establish a guide for proper selection of line materials and various types of cable.

Underground Distribution Systems: The practices and recommended design points connected with underground distribution systems for the refinery are covered here from the planning stage through installation. Numerous problems peculiar to the petroleum refinery, such as available space, hazardous areas, and corrosive soil and water, increase the difficulties of selecting the best materials and installation design. These recommended practices, based on considerable experience, attempt to guide the petroleum engineer and designer through these problems with sound information regarding location of lines, manholes, underground duct systems, drainage, buried cable, cable protection, splices, materials, and so on.

Motors, Generators and Control: Recommendations relative to selection and application of motors and control are subdivided into AC motors, DC motors, AC control, DC control and generating sets. Preferred types of equipment for refinery applications are listed with recommended standard characteristics such as frequency, voltage, ratings and mechanical design. To further increase the scope, the many unusual service conditions under which these types of equipment will operate are classified with recommendations for meeting these conditions through use of proper specifications. Miscellaneous items, such as acceptance tests, maintenance practices and procedure with spare parts, are also covered.

Wiring Practices: This section of the Recommended Practice for Electrical Installations for Refineries is concerned primarily with general specifications on rigid steel conduit, pull boxes and conduit fittings and more detailed specifications on wire insulation. Recommendations for proper selection of wire insulation are included together with general information relative to installation. Specific points which are commonly overlooked, such as termination of wire in oil to prevent siphoning of the oil, are also covered. An attempt is made here, as with other recommended practices, to cover the problems frequently encountered in the refinery and present the proven methods of solving them.

Switchgear: This set of recommended practices is necesarily broad in scope as the selection of switchgear for refinery use, in addition to consideration for installation in hazardous areas, is dependent on the types of distribution system required. Also included here are such closely associated topics as relaying, instrumentation, control power and automatic transfer schemes. Sub-station and load center arrangements together with general circuit design are briefly covered to provide a guide for the designer in the selection of reliable power distribution.

The groups of the API subcom-

Meet The Author

Dr. Lester M. Goldsmith is General Manager of Engineering and Construction for the Atlantic Refining Co., Philadelphia, and Chief Engineer of its subsidiaries, including Atlantic Pipe Line Co., of which he is Vice President in Charge of Engineering. A native Pennsylvanian, he is a graduate of Drexel Institute of Technology and recipient of its Honorary Degree of Doctor of Science.

Back in 1923, he pioneered in the adaptation of Diesel-electric drive to towboats and medium size ocean vessels, also in the electric welding of petroleum pipelines. He developed a high-pressure, high-temperature, turbine electrically driven power plant for the steamship J. W. Van Dyke, which achievement won for him in 1939 the Melville Medal of the American Society of Mechanical Engineers.

During World War II, he worked with the British Ministry of War on the flexible oil pipeline which was extended across the British Channel. He is at present doing consulting work for the U.S. Army Transportation Corps and the Army Engineer Research & Development Laboratories.

mittee working on each of the foregoing send their material in to an editing committee, which now has two sections ready for printing: Overhead Lines, and Underground Distribution Systems.

The Subcommittee on Electrical Equipment has taken one assignment from the general Refinery Equipment Committee which we believe is of great interest to all electrical engineers—to define what is a hazardous location in a refinery. By diligent work by some of our members, it now looks as though within six months we will be able to come up with an intelligent answer that can be used as a guide in the selection of electrical equipment for use in the refineries in hazardous locations. It is evident from the work done so far that there is unanimity of thought in this country even on the type of equipment to use when it is an agreed hazardous location. This is evidenced by the large divergence in engineering in contractors' proposals. Furthermore, it is indicated that there are a considerable number of people both in the refining industry and in the contracting industry who are not aware that explosion-proof equipment is available. It is this difference of opinion and difference in experience that brings to this committee most valuable information, which we hope can be incorporated in the recommendations being promulgated. As an example of this, the committee is almost equally divided as to whether the power lines should be run overhead or underground for refinery equipment installations.

There is still great difference of opinion in the industry between outdoor switchgear and switchgear that is housed in buildings. Some refiners, being cognizant of the high cost of buildings, use nothing but outdoor switchgear, and it has been eminently successful. Many still use indoor switchgear with expensive buildings that have to be heated, lighted and so forth. It should be borne in mind that electrical equipment, unlike mechanical equipment, if designed correctly, installed correctly and let alone, will probably operate longer without attention or maintenance, than any other type of equipment refiners buy today.

One member of our committee is a member of the subcommittee of the National Electric Code. He represents our committee there and is working to keep the code up to date and applicable to our work.

We also have a member of our committee on the American Standards Association, on standards for conduits and so forth.

It should be clearly understood that our group is not attempting to make rules. We are not attempting to do anything that will affect codes in any locality, or the National Electric Code. Our Recommendations for Practice are merely to augment, by suggestions, the right way to do a given electrical installation. If that is successful, it will bring about standardization of equipment for refinery installations, and if that can be accomplished, everyone in the industry will of course buy equipment for less money. The potential usage of electricity and electrical equipment in the refining industry is far greater than most people imagine.

Two technical sessions on Electrical Equipment will be held during the API Refining Division meeting at Hotel Commodore: the first is on Monday, May 11, at 2:00 p. m.; the second is on Tuesday, May 12 at 10:00 a. m.

The preceding article is a condensation of a report made by Dr. Goldsmith at the recent annual meeting of the American Institute of Electrical Engineers in New York City.

Pump Training Manual on Way

Better instruction literature for use in training plant personnel may soon be available from the manufacturers of such pieces of refinery equipment as pumps, compressors, turbines and engines. The improved literature is likely to be noticed in connection with pumps first—perhaps before the end of '53.

For over four years, a subcommittee on pump manuals of the API Refining Division's Committee on Training has been studying the problem of how manufacturers' literature could be made more suitable for training plant maintenance mechanics and operating personnel. At a meeting of the Training Committee in New York next month, this subcommittee hopes to present for adoption a set of "Recommendations for the Preparation and Publication of Pump Manuals."

If this initial effort in the pump field is successful, it is planned to prepare similar recommendations for the manufacturers of compressors, turbines, engines and such major auxiliary equipment.

Pumps were selected for the first attempt since it was thought that pump manufacturers are presently making the best efforts to supply customers with adequate instructional literature. From the work already done in this field by the Hydraulic Institute, the trade association of the pump manufacturing industry, it was decided, valuable experience could be gained toward developing instructional standards for other equipment.

Although it is expected that most pump manufacturers will alter their literature as necessary where it doesn't agree with the suggested practice, there is no compulsion on the part of the API to secure such action. The recommendations do not in any way attempt to prevent or hinder the manufacture or sale of pumps by manufacturers not conforming to the recommendations.

The preparation of the recommendations has been carried out by the Subcommittee on Pump Manuals, working with a Manufacturers' Subcommittee on Pumps. J. J. Stadtherr, refinery training director for Pure Oil Co., is chairman of the refiners' subcommittee; George V. Shaw, chief engineer for Ingersoll Rand Co., is chairman of the manufacturers' subcommittee.

Primary purpose of the recommendations is to get equipment manufacturers to prepare literature which is:

1—Written so that it can be understood by the average plant operating and maintenance personnel, and

2—Organized as to type of information presented and format so that it can be integrated into a refiner's regular training manual.

Refinery training people have learned through experience that most manufacturers go to considerable trouble and expense in preparing elaborate instructions for the installation, operation, lubrication and general maintenance of the items they make. But in many instances this literature is written for the college or engineering level of understanding. Too often it remains in engineering fields, where it doesn't accomplish adequately the purpose for which it was intended—either for the manufacturer or the buyer.

Therefore, the need exists for some means which can make this literature

more applicable to the worker level —which will get it aimed in the right direction.

Advantages on Both Sides

A number of advantages are seen for both manufacturer and user in the adoption of these recommendations:

1—Manufacturers want their equipment to give satisfactory service to the user. Satisfactory service depends more on the operator who uses the equipment and the machinist who maintains it, than it does on the technical engineer who specifies, purchases, and supervises installation. Good training literature, therefore, will help assure properly trained operators and maintenance men.

2—Manufacturers will realize greater advertising value from such instructions. Many decisions for the purchase of specific makes of equipment are based not only on technical data but also on employee reaction to the use of such equipment.

3—Manufacturers can feel assured that they have gone about as far as they can in seeing that their equipment, when it leaves their plant, will be in the hands of a purchaser who will give it fair, intelligent usage.

4—The user, who is certainly interested in satisfactory service from any equipment he installs, will be better able to teach his personnel how to handle the equipment properly. Also, the possibility of failures, which sometimes cause major shutdowns, will be lessened.

5—The refiner's training job will be made easier and less costly, since he won't have to rewrite the manufacturer's literature to make it usable by his plant personnel.

The recommendations that have been drawn up for pump manuals are outlined briefly below:

Classification—Pumps referred to in instruction manuals should be classified as Centrifugal, Rotary or Reciprocating, with various subgroups as established in the pump manufacturing industry.

Nomenclature, Abbreviations, Definitions—Pump and part names, abbreviations, symbols and definitions used in manuals of instruction should agree with the Hydraulic Institute Standards. Symbols or abbreviations should not be used where confusion might exist as to their meaning, although such common terms as rpm, hp, and the like can be used with a parenthetical explanation following their first use.

Parts of the Manual—It is suggested that a title page, index and table of contents be provided when the manual is lengthy—with the table of contents in sufficient detail to facilitate ready reference to specific instructions. The body of the manual should include instructions for installations, operation, maintenance, trouble shooting, and technical data. A glossary of terms and technical symbols used in the manual is considered desirable by users having in operation apprentice or craft training programs.

The session on Training during the API Refining Division meeting at Hotel Commodore will be Wednesday, May 13, at 9:30 a. m.

Organization of Subject Matter—It is suggested that all pertinent subject matter be classified under the six major sections—Introduction, installations, operation, maintenance, trouble-shooting, and technical data. Detailed outlines are given of what type of information should be in each section. For example, under "Maintenance" it is suggested that "This section should include instructions in regard to (a) preventive or routine maintenance, (b) replacement of parts (dismantling and assembly instructions), (c) inspection of parts while disassembled, (d) parts list and recommended spares, (e) ordering replacement parts, and (f) suggested maintenance record form.

Readability—The material should be written in a manner consistent with the educational level of the operating and maintenance personnel for whom it is intended. The subject matter should be arranged, and indexed where required, in a logical fashion which permits ready reference to specific instructions. One recommendation which may be made is that the material have a score of 70 or higher according to the readability test of Dr. Rudolf Flesch, as described in his book "How to Measure Readability." According to Dr. Flesch's method of scoring, 60 to 70 is "standard" (such as *Readers Digest*), 70 to 80 is "fairly easy" (slick fiction), 80 to 90 is "easy" (pulp fiction), and 90 to 100 is "very easy" (comics).

Recommendations are also made as to the standard format to be followed, quality of paper stock, and illustrations.

Steels Deterioration Is Studied

SOME 125 samples of metal from refiners' processing vessels and piping have already been examined in Battelle Memorial Institute, Columbus, Ohio in the investigation of the deterioration of steels after long service at temperatures from 850° F. up. The study is being sponsored by the Refining Division of the American Petroleum Institute.

The results of these examinations will be discussed as one feature of the Symposium on Deterioration of Metals, during the Mid-Year meeting of the Division, May 11-14, in New York.

The check-up on the condition of long service steels, in which refiners generally have been asked to participate, is part of the program which stems from the discovery of damage to the metal in the reactors of three Fluid catalytic cracking units after 53,000 hrs. of service, which first came to light about two years ago.

For the examinations at Battelle Institute, refiners are asked to take samples by prescribed methods. The samples are taken from carbon and carbon-molybdenum steel vessels and piping that has been operated at or above 800° F., particularly in heat affected areas near welds. Four years' operation (35,000 hrs.) is considered a reasonable minimum time limit for sampling, unless the equipment has been operated in the upper end of the so-called safe temperature range for steels, i.e. 950° F. or higher.

Depending on circumstances, laboratory analysis at Battelle includes investigation of:

Microstructure
Chemical analysis
Physical properties

1—Tensometer bar test
   (a) Tensile strength
   (b) Yield point
   (c) Elongation
   (d) Reduction of area
2—Bend test
3—Impact test
4—Carburization test for grain size and normality.

In addition to the examination of steels from refiners' equipment, the API-sponsored program includes studies of the manufacture of steels which have been affected, and the experience of other industries where similar conditions have been found. The eventual goal of the program is to provide refiners with information on types of steel to select for this range of operating conditions, and on the construction of vessels to minimize temperature effects. Inspection techniques will be worked out

which refiners can follow to detect evidence of metal deterioration in vessels and piping operating at high temperatures.

In its early stages, the API study was termed the Graphitization Program because it was believed the cause of the damage to the reactor walls of the cracking units was "graphitization", the formation of graphite in the steel by the decomposition of the iron carbide. Some forms of graphitization lead to cracks in the metal. It is now belived that other causes, resulting from the stresses to which the metal in large vessels is exposed, contribute to the deterioration of the steel.

The industry's first experience with this particular operating difficulty occurred on Feb. 8, 1951, when an engineer on the grounds of the Humble Oil & Refining Co.'s Baytown, Texas, refinery noticed oil vapors coming from the insulation on the walls of the reactor of a Fluid catalytic cracking unit. The vessel, approximately 68 ft. in height and 23 ft. in diameter, had walls 1⅜ in. thick, of carbon steel with an integrally bonded liner of 18 Chrome-8 Nickel steel. The oil was immediately removed from the vessel and a complete shutdown begun. Removal of the insulation in the vicinity of the leak disclosed a crack about 8 in. long, adjacent to a vertical welded seam. Further observations showed both the carbon steel and the alloy cladding contained cracks, mostly independent of each other.

The processing unit had been in service some 53,000 hrs. Two reactors, at other refineries, had been in service about the same length of time. Examination showed damage to the metal in these units.

No public reports were made at the time of these instances of vessel failure. Word of this new—to the oil industry—phenomenon in the behavior of steels spread among engineers and metallurgists, however. The API Refining Division's Committee on Equipment scheduled a meeting of its members to discuss the subject, at the Division's general meeting in Tulsa in early May of '51. Over 200 refinery men jammed into the room to hear the reports from the committee's investigators.

The session on Deterioration of Metals during the API Refining Division meeting at Hotel Commodore will be Monday, May 11 at 9:00 a. m.

In this meeting originated the API program to study the causes of the deterioration of steels in refinery vessels and piping operating at high temperatures. Other scientific organizations having to do with the behavior of steels asked to participate; the American Society for Testing Materials, American Society of Mechanical Engineers and a group from the Welding Research Council of the Engineering Foundation. Interest of the last named group comes from the fact the evidence of damage is most frequently found in the heat-affected zones of welds.

Committee Activities—1952

Annual progress reports on programs under way by Refining Division technical committees

One of the most important activities of the API Division of Refining is to organize and coordinate various technical committees, which carry out studies and projects of mutual interest to the processing industry. To acquaint the industry more fully with the work of these committees, PETROLEUM PROCESSING is again publishing these annual progress reports. They have been prepared for us by the committee chairmen, with the cooperation of W. T. Gunn, director of the Division, and his staff.

Petroleum Products

Chairman: A. E. Miller
Sinclair Refining Co.

THE Committee on Petroleum Products represents one of the oldest actvities in the API. Although the present name of the committee dates only from 1946, it traces its history back to July 22, 1921, when invitations were issued to a number of petroleum technologists to become members of an "Advisory Committee on Petroleum Testing Methods of the American Petroleum Institute."

The activities of the committee and its forerunners have been many. The first job entailed a decision as to how API should implement the resolution adopted by the Board of Directors, December 3, 1920, "that the American Petroleum Institute cooperate with the existing agencies for the purpose of promulgating and applying a standard code of testing methods and urging the general adoption of such a code."

At this late date the quoted resolution seems a bit naive. The older technologists of the industry will recall, and the younger ones may be glad to learn, that we did not arrive at our present state of sophistication without travail. There were no generally accepted test methods in 1921, and it was not until April 29, 1922 that petroleum technologists agreed that API should support the program of the American Society for Testing Materials for the development of a uniform body of methods of testing petroleum and its products. Immediately upon the accomplishment of this agreement, an API staff employe was made available to serve as Secretary of ASTM Committee D-2 on Petroleum Products and Lubricants and this service has been available to the ASTM Committee continuously since that time.

In 1922, the Subcommittee on Viscosity Standards was established to study the matter of viscometer calibration. This subcommittee is still functioning to maintain and distribute Oil Standards for calibrating viscometers. At the present time three oil standards are available; Alpha,

Beta, and Gamma. Saybolt Universal and Furol viscosities, and Kinemetic viscosities are determined each year on each oil. The number of oils, the range of viscosities, and the temperatures of calibration can be increased whenever the demand for such extension requires it.

One of the more recent activities of the committee was the compilation of a Glossary of Terms used in Petroleum Refining. The glossary is only recently off the press and is the result of more than five years of study, sifting and selection of definitions.

In compiling the glossary, the committee did not attempt to write any original definitions. To begin with, a collection was made of all published glossaries in this field. Then the glossaries of all the oil companies that had such were collected. The terms were catalogued and where a variety of definitions existed, a definition acceptable to all members of the Glossary Subcommittee was selected. The resulting compilation should prove to be a worthwhile instrument to both technical and nontechnical workers in refining.

For the past four years API has maintained a fellowship on Vapor-Temperature relationships at Northwestern U. The primary purpose of the fellowship was the development of more accurate correlations to permit the correction of vapor temperatures at sub-atmospheric pressure to the condition of standard pressure. One natural outgrowth of the work was the development of an improved Cox Chart, very useful to engineers designing fractionating equipment.

The committee has fostered research on several subjects pertaining to the testing of petroleum products. One project, carried out at the Franklin Institute, Philadelphia, investigated the use of a vibrating crystal for the determination of viscosity of petroleum products. The device proved to be uninteresting for use with lubricants but showed possibilities in connection with rubbers and other high polymers.

Another project investigated the influence of atmospheric pressure on octane determinations. The committee initiated recommendations that resulted in the API's raising money to finance the expansion by ASTM of the National Standard Petroleum Oil Tables published by the National Bureau of Standards (Circular C 410).

A late project of the committee, about to come to fruition, is the establishment of a technical abstracting service in the API. This service will be available to subscribers and will be self-supporting.

A recent demonstration of the usefulness of the Committee on Petroleum Products occurred in January 1952, when the National Bureau of Standards announced a new value for the absolute viscosity of water at 20° C., and also that the Bureau would begin using the new value July 1, 1952. That date was subsequently changed to July 1, 1953.

The important decisions as to how this new value is to be applied in the petroleum industry have been made by ASTM Committee D-2, and are described in a separate story in this issue (pg. 525). But the Committee on Petroleum Products watched the development of this subject in D-2, and by the time the decisions were reached, had initiated recommendations that resulted in the provision of monies to pay the cost of recalculating new factors for expressing the relationship betwen Kinematic and Saybolt viscosities, and for constructing new Viscosity Index Tables.

Training in Refining

Chairman: D. S. Turner
Standard Oil Co. (Ohio)

THE Committee on Training in Refining is interested in improving training in the industry by developing better training aids, techniques, and methods, and keeping the industry informed on significant training developments and training needs.

The Subcommittee on Pump Manuals has as its objective the standardization and improvement of training material published by the manufacturers of refinery pumps. John J. Stadtherr and his subcommittee have developed standards for publishing pump manuals for training purposes. These standards have been reviewed with a pump manufacturer's subcommittee headed by George V. Shaw. The cooperation of the pump manufacturers has been excellent and positive results of the work of these two subcommittees should be evident by the end of 1953. (A more detailed story on what this committee is doing appears in this issue—pg. 529.)

The Subcommittee on Training Literature has established a library of training materials used by the refining industry as a part of the API library. Raymond R. Faller, chairman, stated that his subcommittee is planning on soliciting the entire refining industry for training materials in the near future. They are also planning to make available to the refining industry a list of the training materials housed in the library.

The Subcommittee on Laboratory Methods, LeRoy Wilkie, chairman, is doing some research on the "Standard Methods of Tests", published by the American Society for Testing Materials, with the hope that a way can be found to increase the utility of these publications for training purposes.

The committee sponsored a group session at the San Francisco meeting. Three outstanding papers were presented, two on communications and one on fire prevention training. Plans are being made to sponsor another group session at the Midyear Meeting in May, 1953.

Another important function of the committee is the opportunity provided at its meetings for the discussion of training problems, programs, developments, and techniques. These discussions provide the members with an up-to-date picture of what is happening in training throughout the industry.

The committee has one active area subcommittee known as the Gulf Coast Committee on Training. It is composed of approximately 25 active members, and meets twice a year. They have assisted the Committee on Training in Refining on many projects, and have been the stimulus for other areas giving consideration to forming similar subcommittees.

Refinery Equipment

Chairman: W. H. Creel
Phillips Petroleum Co.

THE Committee on Refinery Equipment has the responsibility of fostering the API program of standardization of refinery equipment and of formulating recommendations

on engineering practice in the promotion of safety for the plant, worker and general public.

This committee is composed largely of chief engineers in refining. They are busy people these days and their chief difficulty is finding time to do all that is required of them. The allocation of time for committee work, therefore, must be based on the view that time spent on such work will result in an ultimate saving of man hours during the coming years.

Projects of the committee are assigned to working subcommittees, the members of which are, for the most part, members of the staffs of the members of the committee. Altogether—engineers make up the membership of the committee and its subcommittees.

Projects during 1952 were:

Unfired Pressure Vessels—A Subcommittee on Unfired Pressure Vessels, N. J. Rees, chairman, has developed the art of design, construction, inspection, and repair of unfired pressure vessels for petroleum liquids and gases during more than 25 years of engineering progress. The results of these studies are embodied in the API-ASME Code for Unfired Pressure Vessels. During 1952 the subcommittee initiated a study of the phenomena of deterioration of steel in high-temperature service. An investigation of graphitization in pressure-vessel steels in service was installed at Battelle Memorial Institute and is being directed by the subcommittee. It is too early to predict the results of this investigation, but it is safe to assume that our knowledge of steel and of what happens to it in service will be increased.

Pressure-Relieving Systems—A Subcommittee on Pressure-Relieving Systems, J. C. Souder, chairman, has been studying the design and construction of pressure-relieving systems since 1945. An investigation, sponsored by the API and directed by the subcommittee, and conducted at the University of Michigan in 1946 and 1947, determined and recorded the various approaches to the design of pressure-relieving systems in use in the industry. Since that time the subcommittee has attempted to formulate the members' conclusions on recommended practices for design of such systems that will be consistent with long operating experience. Because of the great variance in the physical data on refinery operations of pressure equipment, such data are always controversial, and the design problems which require study in order to arrive at sound conclusions are no exceptions to that rule.

Corrosion—A Subcommittee on Corrosion, E. Q. Camp, chairman, fosters the study of corrosion in refineries. As a result of the increasing importance of this subject, a discussion of the corrosion program of the Division of Refining is planned for the Eighteenth Midyear Meeting in New York next month. The discussion will be held in a meeting of the Committee on Refinery Equipment and may result in a reorientation of the work. Results of the discussion should become available before 1954.

Electrical Equipment—A Subcommittee on Electrical Equipment, L. M. Goldsmith, chairman, is particularly reviewing the recommended practices for refinery installations of electrical equipment and its inspection, with the aim of referring its recommendations to the Subcommittee of Refinery Inspection Supervisors for approval as Part VI of the Recommended Practices for Refinery Inspections. The subcommittee also sponsors symposia on electrical distribution systems in refineries.

Mechanical Equipment—The Subcommittee on Mechanical Equipment, E. F. Voss, chairman, is working in co-operation with a Manufacturers' Subcommittee on Centrifugal Pumps, Lynn Sawyer, chairman, to develop Recommended API Standards for Refinery Pumps, to include all types of pumps that can be used in refineries.

Large Low-Pressure Storage Tanks—The Subcommittee on Low-Pressure Storage Tanks, W. L. Bowler, chairman, in co-operation with a Manufacturers' Subcommittee, H. C. Boardman, chairman, is now reviewing the second draft of recommended rules for the design, construction, and inspection (including an appendix on good practices for foundations) of welded pressure tanks and vessels for service over the pressure limitations of API Standard 12 C, "Specification for Welded Oil Storage Tanks," and below these limitations in the API-ASME Code for Unfired Pressure Vessels for Petroleum liquids and Gases—that is, at 15 psi. or less.

Inspection Procedures for Refineries—The Subcommittee of Refinery Inspection Supervisors, J. H. Urian, chairman, has approved Part V, Instruments, of the Recommended Practices for Refinery Inspections, subject to last-minute reviewers' suggestions for changes. During the last half of the year, a Designers' Subcommittee, J. H. Rickerman, chairman, was organized from a group of engineering representatives of ten large constructors of complete processing units in refineries, to work with the refiners subcommittee in preparing a modernized revision for Part I of the Recommended Practices for Refinery Inspections. A preliminary outline is now being expanded by separate working groups in order to develop the writing of what, in effect, will serve as a "text book" on refinery inspection practices as based on long experience.

Tank Accessories and Cleanouts—A Subcommittee on this activity, E. E. Kerns, chairman, is considering the preferred type, size, and location of bottom sumps, and quick-opening roof manheads.

Automotive Research

Chairman: J. T. McCoy
Tide Water Associated Oil Co.

THE Automotive Research Committee sponsors investigations and forums promoting the effective utilization of fuels and lubricants.

During the past year the committee arranged for the Southwest Research Institute to assemble and analyze data supplied by the oil companies on the vapor locking tendencies of automobiles. Results of this equipment survey will be made public at the meeting of the Division of Refining in New York in May. Also at this meeting the Automotive Research Committee is sponsoring three group sessions on motor fuels, gasoline volatility, and lubricating oils.

In cooperation with the U. S. Bureau of Mines, fuel surveys are issued annually on motor gasoline, aviation gasoline, diesel fuels and jet fuels. The API arranges for the petroleum industry to contribute data, which are tabulated and analyzed by the Bureau, and then made public.

Most of the research projects of interest to the committee are conducted by the Coordinating Research Council, a non-profit organization sponsored jointly by the petroleum and automotive industries. The Committee formulates recommendations for API support of CRC and its projects.

Typical projects which have been undertaken by CRC recently have included an investigation of storage stability of diesel fuels, gasolines, and jet fuels; research on fundamentals of combustion by high-speed photography; surveys of octane requirements of passenger cars, trucks, and military vehicles; full scale tests on

diesel fuels in railroad locomotive diesel engines; and an investigation of a wide range of diesel fuels in the constant-volume bomb at the Bureau of Mines. Aviation research is concerned primarily with jet turbines and fuel characteristics. In the field of lubricating oils the development and design of a test engine is a major project.

Although the emphasis of CRC has been on military projects, much of the work is of direct benefit to the motoring public.

Smoke and Fumes

Chairman: W. L. Stewart, Jr.
Union Oil Co. of California

THE Smoke and Fumes Committee was formed last year as the result of an industry-wide feeling that there was an urgent need for the development of accurate information concerning the growing problem of air pollution.

The committee proposes to develop reliable information concerning the problem and the contributions of both the petroleum industry and its customers to it by sponsoring research projects on its causes. These research projects will be placed at various non-profit research institutions and universities throughout the nation.

The proposed program lists projects of both applied and fundamental research nature. In the future it is hoped that the program can be shifted entirely to the fundamental type approach. Certain applied research type projects must be carried on at the present time, however, in order to obtain data by which to either disprove or confirm claims regarding the petroleum industry's responsibility for "smog" in the Los Angeles area which have been advanced by the local air pollution control agency and accepted as proven fact by similar agencies at widely distant locations. In order to prevent the petroleum industry being made to comply at great expense with unnecessary ordinances, it is essential that it know more about the air pollution problem than the policemen. The program of the Smoke and Fumes Committee is designed to supply the needed information.

The committee held its first meeting last May. During the following months a program was planned which was adopted by the committee at its next meeting in Chicago this past November. At that time authorization was given to solicit the industry for funds with which to carry out the proposed program. At this meeting a four-man Executive Committee and an Executive Secretary were appointed.

The Executive Committee met with the Director, Division of Refining and the Executive Secretary during the latter part of January and appointed an *ad hoc* five-man Technical Advisory Committee to assist the Executive Secretary in selecting the research institutions best qualified to conduct research on the various projects.

This Technical Advisory Committee met with the Director, Division of Refining and the Executive Secretary during February and recommended several additional institutions should be contacted in regard to certain projects before final decisions regarding their placement were made. These recommendations have been followed, and by the end of March contracts were expected to have been signed for the majority of the proposed projects.

Included in the program are the following proposed projects:

1—Selection and demonstration on an industrial scale of the method most suitable for the application of tracer techniques to the determination of the path of gases after emission from a given source. Radioactive substances, finely divided fluorescent substances, dyestuffs, etc. are to be considered in choosing the particular material to be used as the substance to be traced but particular consideration shall be given to radioactive substances.

2—Determination of the amount and types of partially oxidized hydrocarbons, thermally cracked hydrocarbons and unchanged hydrocarbons present in the effluent gases from the various types of domestic and industrial devices and furnaces burning petroleum products. It was decided that under this same project head, a study also should be made of the amount and composition of the organic materials issuing from the breather vents of automobile crankcases.

3—A survey of the literature and preparation of a bibliography of references to air pollution, both by gases and particulate matter, which should be of interest in connection with the Smoke and Fumes Committee projects. In making this survey, particular emphasis will be placed upon analytical methods and uncovering of unpublished references available from former air pollution studies conducted by non-profit research institutions.

4—A survey of the ozone content and ozone forming capacities of the atmospheres of selected industrial cities.

5—Development of methods suitable for the quantitative estimation of the amounts of the various nitrogen oxides and nitric acid present in polluted industrial atmospheres undergoing irradiation by sunlight.

6—Study of the effect of various nitrogen oxides, nitric acid, and various particulate matter upon the sulfur dioxide-sulfur trioxide equilibrium in an atmosphere irradiated by sunlight.

7—Development of a method for the quantitative determination of small amounts of ozone in polluted industrial atmospheres. The method developed should depend, if possible, upon physical rather than chemical properties of ozone and should be specific for ozone.

8—Study of the reactions occurring in sunlight between nitrogen dioxide and hydrocarbons of the various types present in gasoline.

9—Investigation of the kinetics of the reaction, in sunlight, of ozone with hydrocarbons of the various types present in gasoline and the determination of the relative amounts and nature of the products formed.

10—Study of the mechanism of the reaction leading to the formation of ozone in polluted industrial atmospheres.

11—Development of a method for the determination of the amount of total organic substances in polluted industrial atmospheres.

Disposal of Refinery Wastes

Chairman: R. N. Giles
Standard Oil Co. (Indiana)

THE Committee on Disposal of Refinery Wastes has the responsibility of collecting and publishing in manual form technical information

that will be of assistance to refiners for the efficient handling and disposal of waste materials. The committee is divided into eight subcommittees and has a total membership of 47 people.

In 1952, the committee was primarily concerned with revising Volumes I, II, and III of the API Manual on the Disposal of Refinery Wastes. This revision was necessary in order to incorporate new information on waste disposal and to segregate the sections on analytical techniques for both water and air contaminants into two new Vols. IV and V, respectively. The status of preparation of the new manual is as follows:

Vol. I, "Waste Water Containing Oil"—The fifth edition was published in March, 1953.

Vol. II, "Waste Gases and Particulate Matter"—The fourth edition was issued in May, 1952. Work leading to the expansion and revision of this edition is now underway. New information will include a section on flare stack designs. No publication date for the fifth edition has been set.

Vol. III, "Chemical Wastes"—The second edition (1951) is being expanded to include a section on the following topics: (1) Biological Treatment of Wastes, (2) Treatment of Phenolic Wastes and (3) Chemical Oxidation of Wastes. This work is about 50% complete.

Vol. IV, "Sampling and Analysis of Waste Water" and Vol. V, "Sampling and Analysis of Waste Gases and Particulate Matter"—The first editions of these volumes are being readied for publication by the summer of 1953.

In May, 1952, the Academy of Natural Sciences in Philadelphia was assigned a three-year project to check the applicability of a certain bio-assay method to bodies of water typical of those into which petroleum refineries discharge wastes. This study will get underway during the Spring of 1953. A project concerned with the effects of fluorides in refinery wastes on vegetation is being continued at the Boyce Thompson Institute.

Committee attention is being given to the following projects: (1) the evaluation of gas flotation as a means of removing oil from waste waters, (2) the investigation of economical methods for handling and disposing of oily sludges and clays, (3) a study of the relative merits of circular and rectangular oil-water separators, and (4) the development of the design of an all-purpose incinerator.

Two committee meetings were held in 1952. The first was in May at San Francisco and the second in September at Chicago. At the May meeting, in addition to business sessions, a panel discussion was held on the subject of flare design. Several papers were given that reviewed the design and operations of smokeless flares. The Chicago meeting was devoted entirely to business sessions.

At the 1952 Mid-Year Meeting of the API Division of Refining, the committee sponsored a symposium of three papers on the subject of atmospheric pollution.

Committee members contributed papers for a symposium on the subject "Industrial Waste Disposal Problems of the Petroleum Industry" sponsored jointly by the Division of Water, Sewage and Sanitation Chemistry and the Petroleum Division of the American Chemical Society at the 123rd National Meeting of the Society in March, 1953 at Los Angeles. The Committee Chairman and R. F. Weston of Atlantic Refining Co. acted as co-chairmen of this symposium.

Analytical Research

Chairman: C. E. Headington
Atlantic Refining Co.

THE purpose of the Committee on Analytical Research is to develop new analytical methods and techniques which will aid the petroleum industry in refining operations. The objective of the group is not to standardize methods but to originate, develop and evaluate them. The results of its work are made available through group sesisons on analytical research at API meetings. The papers presented in these group sessions are then published in *Analytical Chemistry*.

Most of the work of the committee is carried out in 11 subcommittees.

The Subcommittee on Analysis of Cracking Catalysts is doing cooperative work on the development of both chemical and spectrographic procedures. Synthetically contaminated catalysts have been distributed and the results should be available at the next meeting. The objective of this group is to develop methods for determining metallic contaminants on catalysts.

The Subcommittee on Trace Elements in Crude Oils and Charge Stocks is continuing its investigation of techniques for concentrating the metallic content of these oils. Various methods of ashing the oil have been investigated as well as methods for extracting the metallic impurities. X-ray fluorescence methods will also be investigated as a direct means of determining the metals in the oil.

The Subcommittee on Analysis of Oxygenated Compounds has been cooperatively analyzing two oxidized turbine oils for total oxygen by the modified Unterzaucher procedure and oxygen type functional group analyses. The results of this work will be reported at the next meeting.

The Subcommittee on Measurement of Physical Properties of Cracking Catalysts has been organized during the past year and is now making a preliminary study of the procedures for physical property measurement that are currently being used in the industry. Many of these procedures will subsequently be evaluated in order to determine their relative merits.

The Subcommittee on Determination of Naphthenic Hydrocarbons is also a new activity. The members are currently employing their own individual methods to analyze a cooperative sample of light naphtha for cyclohexane and methyl cyclopentane. These results will be presented at the next meeting and at that time a comparison of methods will be made.

The Subcommittee on Refinery Effluent Water Analytical Methods has been developing and evaluating methods for determining oil and phenols in refinery effluent waters. To date three new methods for oil determination and two new methods for determining phenols have been developed.

The Subcommittee on Determination of Sulfur and Sulfur Types has prepared pure carbonyl sulfide and is now comparing methods of analysis. Adequate polarographic and chemical methods for elemental sulfur have been demonstrated and the interference of polysulfides on this determination is being considered. Information is being accumulated in preparation for a study of type analysis.

The Subcommittee on Analytical Methods for Atmosphere has been organized recently and is now pooling all available information on this subject. It will be in a position to lend analytical assistance to the Committee on Smoke and Fumes.

The Subcommittee on Group Sessions has organized a Group Session on Analytical Research for the Mid-year meeting to be held in New York on May 11. Included in the program of papers will be reports of the work of the Subcommittees on Oxygenated Compounds and Refinery Effluent Water Analysis. (Abstracts of most of the papers on the program appear in this issue—pg. 536.)

Mr. Headington

Mr. Lake

Mr. Dyroff

Mr. Hansen

Mr. Hodgkins

THE 26 PHOTOS on this and the next two pages are the speakers at the API sessions on analytical research

Analytical Research Sessions

Abstracts of papers on twelve different methods, covering lube oils, fuel oil, residues, wastes, many other topics

THE complex nature of petroleum refining today, with its need for more accurate methods of test and analysis, has greatly broadened the work of the API Refining Division's Committee on Analytical Research. The committee is frequently called upon to cooperate with other Refining Division technical groups where new or improved test procedures are required in their programs.

As an example of this latter function, the Analytical Research Committee has sponsored work in several oil company laboratories to develop and evaluate new methods for measuring the amounts of oil and phenol contained in effluent waters. These tests will aid the work of the Refining Division's Committee on Disposal of Refinery Wastes in developing improved methods for handling liquid wastes containing these materials.

The new techniques for oil and phenol include methods for finding as little as a few parts of either of these materials in a billion parts of water. Recent advances in stream pollution abatement have reached a point where future progress is recognized as depending on developing such analytical techniques having greater sensitivity than could previously be attained.

The findings of the Subcommittee on Refinery Effluent-Water Analytical Methods are to be presented in one of the papers to be given at the sessions on Analytical Research, at the API Refining Division meeting in New York, May 11-14. C. E. Headington, Atlantic Refining Co., Philadelphia, is chairman of the subcommittee.

Cooperative work of a number of laboratories on methods for the determination of oxygen content in petroleum and related compounds is also to be reported at the sessions on Analytical Research. Their work has shown that oxygen can be accurately analyzed in concentrations down as low as 100 ppm. (0.01%). Heretofore accurate determinations were limited to oxygen concentrations of 1% or higher.

This work has been sponsored by the Subcommittee on Analysis of Oxygenated Compounds of the API Committee on Analytical Research. Chairman of the sucommittee is W. H. Jones, Esso Laboratories, Esso Standard Oil Co., Baton Rouge, La.

The complete program for the two group sessions on Analytical Research, both of which will be held Monday, May 11, follows, with abstracts of each paper.

Analysis of Petroleum Residues

"Comparison of Methods for Analyzing Petroleum Residues," by G. V. Dyroff, John Hansen and C. R. Hodgkins, Standard Oil Development Co., Linden, N. J.

Under this general topic three papers will be presented as follows: (A)—"A Statistical

Mr. Davis

Mr. Van Nordstrand

Mr. Poti

Mr. Gent

Mr. Pomatti

Mr. Levin

Mr. Brown

Mr. Skahan

Mr. Key

Mr. Hoggan

Study of Semi-Micro Methods of Analyses of Ashes from Petroleum Stocks," by Dyroff, (B)—"The Analysis of Petroleum Ashes and Deposits by a Spectrochemical Method," by Hansen and Hodgkins, (C)—"A Comparison of Spectrochemical and Semi-Micro Methods in the Analysis of Petroleum Ashes," by Dyroff, Hansen and Hodgkins.

Although many methods for determining these trace elements, such as iron, nickel, vanadium, and sodium, are available to the analytical chemist, not all are equally acceptable. How good are they? The ease of operation, the cost of analysis, and the precision and accuracy attainable must be critically evaluated in order to choose a satisfactory procedure of analysis.

These three papers show how statistical treatments afford a method of determining the variables of different methods, the accuracy and precision which can be expected of a given method, and a means of comparing methods—thereby enabling them to make a wise decision as to which method should be used for analyzing materials for these trace elements.

Barium, Calcium and Zinc In Lubricating Oils

"The Use of X-ray Fluorescence in the Analysis of Lubricating Oils for Barium, Calcium and Zinc," by Elwin N. Davis and Robert A. Van Nordstrand, Sinclair Research Laboratories, Inc., Harvey, Ill.

Most lubricating oils of today contain metal compounds, added as detergents, antioxidants, dispersing agents, or corrosion inhibitors. Control of the manufacturing process requires that each batch of these oils be carefully analyzed to assure proper additive concentration. Conventional chemical methods are time-consuming and tedious, often delaying the manufacturing process. The method described in this paper makes use of the X-ray spectrograph for the determination of barium, calcium, and zinc additives in oils at concentrations of 0.01 to 1.0 per cent. Analysis for any one of these metal compounds can be completed in 5 to 10 minutes with accuracies comparable to the best chemical methods.

Hindered-Phenol in Lube Oil

"Determination of a Hindered-Phenol 4-Methyl-2, 6-di-tert-butylphenol in Lubricating Oils by Infrared Absorption," by Emil Poti, L. L. Gent, R. C. Pomatti and Harry Levin, The Texas Co., Beacon, N. Y.

One of the additives currently employed in certain lubricating oils to retard oxidation is a complex chemical, viz., 4-methyl-2, 6-*di-tert*-butylphenol. Quantitative analysis for this additive is important in following the condition of an oil in continued service for prolonged periods.

The method described is based on the fact that the intensity of a beam of infrared radiation, which passes through a layer of the lubricant, is proportional to the additive present.

Initially, the chief obstacle to the success of this approach was that the base oil in the lubricant also has a definite effect on the intensity of the infrared radiation. However, it was found that the additive could be removed by volatilization at about 280° F. The infrared radiation of the base oil was then determined, and this effect subtracted from that due to the base oil plus the additive. This formed the basis for determining the complex oxidation inhibitor.

Low-Temperature Distillation

"The Application of Metal Valves and Teflon Packing Glands in Low-Temperature Distillation Apparatus," by R. A. Brown and D. J. Skahan, Atlantic Refining Co., Philadelphia, Pa.

In order to determine light components in gasoline, a sample may be subjected to low-temperature fractional distillation, followed by spectrographic analysis. Hydrocarbons, however, tend to dissolve in the stopcock grease in the distillation system, and may then reappear as a contaminant in a later sample.

This paper describes a method of eliminating this contamination by substituting metal valves for stopcocks. To do this, a convenient method for connecting metal to glass was accomplished by using Teflon packing glands. Other pertinent uses for these glands are discussed.

Trace Elements in Fuel Oils

"A Direct Spectrographic Method of Analyzing Fuel Oils for Trace Elements," by C. W. Key and G. D. Hoggan, Richfield Oil Corp., Wilmington, Calif.

A new spectrographic method of determining minute concentrations of metallic elements in residual fuel oils has been developed. It quickly and accurately determines sodium, vanadium, nickel, and calcium in concentrations as low as a few parts per million or less. A graphite-disc electrode, rotating through the sample to be analyzed, introduces a film of oil into a high-voltage electrical discharge in the spectrograph. The light rays from the excited atoms are dispersed to form dark lines on a strip of 35-mm. film. The metallic elements present in the fuel oil, and their concentrations, can then be determined from the line positions and intensities. The new technique provides a means of determining trace elements in residual fuel oils in a matter of minutes, instead of days, as required by conventional chemical or spectrographic procedures.

Even extremely low concentrations of metallic constituents in fuels may, in certain combinations, be of serious concern in such modern, high-temperature, power generators as gas turbines. In other cases trace quantities of metallic compounds may have a very beneficial effect; therefore, it is extremely important that accurate analyses be performed on these materials during processing, transportation, storage, or use. Most crude petroleum contains minute quantities of metals of geological origin. These may be completely removed during processing, or they may be concentrated in the heavier fractions. When the latter occurs, it may be necessary either to reduce their concentration by treating or to render them ineffective by the addition of other metallic compounds. In order to be successful, it is imperative that precise analyses be made at frequent intervals. The older methods heretofore used could not be made with sufficient rapidity to be of maximum benefit. The new direct method overcomes this handicap.

Fuel Oil Pumpability

"The Pumpability of Fuel Oils," by F. Gill and R. J. Russell, Anglo-

Mr. Gill

Dr. Russell

Dr. White

Mr. McArthur

Mr. Baldeschwieler

Mr. Jones

Mr. Melpolder

Mr. Warfield

Iranian Oil Co., Sunburry-on-Thames, Middlesex, England.

The circumstances giving rise to present concern about pumpability are enumerated; and the fundamentals of the subject are discussed by proceeding from regular, or Newtonian, to anomalous viscosities. The shortcomings of pour point as a measure of pumpability are pointed out, and the yield value of the oil is advocated as a more significant property which, together with rate of shear-shearing stress data, can be related to the characteristics of an installation to predict the joint oil-installation behavior.

Methods developed and used by the Anglo-Iranian Oil Co. to measure yield values and oil-flow characteristics are described; and the sensitivity of pour point and of yield value to heat treatment and storage are discussed.

The attainment by laboratory treatments of maximum and minimum fluidity states; the intermediate fluidity normally appropriate to a fuel in bulk storage and use; and practical installation characteristics, all are examined, and shortcomings in the correlation between laboratory test results and the full-scale are emphasized.

Some consequential problems of pumpability and anomalous viscosity are indicated, together with some practical means of dealing with them on the full scale.

Statistical Evaluation of Test Reproducibility

"Statistical Evaluation of the Reproducibility of Testing between Petroleum Refinery Inspection Laboratories," by W. Harold White, Imperial Oil Ltd., Sarnia, Ontario, Canada, and D. S. McArthur, Standard Oil Development Co., Linden, N. J.

Uniform quality is important in the national marketing of petroleum products such as gasoline and oil. To insure uniform quality, most refineries have inspection laboratories staffed by skilled chemists and technicians. These laboratories measure quality by running standard tests. It is important that these tests be run the same way in every laboratory.

This paper describes a cooperative program of testing designed to see that all laboratories are running the tests the same way. The same sample of gasoline (or other petroleum material) is analyzed in as many laboratories as practical under normal conditions, and the results are examined using statistical methods. The statistical evaluation shows which laboratories, if any, are out of line so that their test procedure can be improved. Several examples are described in the paper.

Evaluating a Test Procedure

"How to Evaluate a Test Procedure," by D. S. McArthur and E. L. Baldeschwieler, Standard Oil Development Co., Linden, N. J.; W. Harold White, Imperial Oil Ltd., Sarnia, Ontario, Canada; and J. S. Anderson, Esso Standard Oil Co., Baton Rouge, La.

This paper shows how test procedures can be evaluated using statistical techniques. The method consists essentially of running a round-robin exchange of samples among several laboratories. Each laboratory tests each sample three times on different days. The results are then tabulated and "combed" by statistical methods for "wild" results. This preliminary "combing" pin-points those laboratories which need help in improving their test technique. The good data are then analyzed to obtain a working estimate of the repeatability (ability to check results within one laboratory) and the reproducibility (ability to check results between different laboratories) of the test method. The analysis shows whether the test can be used in different laboratories and on different samples with equal dependability.

This method of evaluating test procedures is proving helpful among the various laboratories affiliated with the Standard Oil Co. (New Jersey). It is presented here in the hope that it may be helpful to others faced with the problem of standardizing test procedures.

Oxygen in Organics

"The Direct Determination of Oxygen in Organic Compounds," by W. H. Jones, Esso Standard Oil Co., Baton Rouge, La.

A Report of the Subcommittee on Analysis of Oxygenated Compounds, of the Committee on Analytical Research of the API's Division of Refining.

As a result of the cooperative efforts of several petroleum laboratories, oxygen can now be accurately and precisely analyzed in concentrations down to as low as 100 ppm. (0.01%). Although reasonably accurate methods have been available for determining oxygen in concentrations of 1% or higher, heretofore the analysis in the low and very low range has not been possible with any degree of accuracy or precision.

The significance of this analytical development extends far beyond the petroleum industry because it can be applied to practically any organic compound, requiring only a few milligrams of sample for analysis.

Volatile Contaminants

"Mass Spectrometer Determination of Volatile Contaminants in Water," by F. W. Melpolder, C. W. Warfield and C. E. Headington, Atlantic Refining Co., Philadelphia, Pa.

Petroleum chemists have devised a method which is capable of identifying as little as one part of gasoline, kerosine, or furnace oil in a billion parts of drinking water. Furthermore, the method can tell you whether the oil is a petroleum product or a product from some other industry.

Oil Content of Effluents By Direct Extraction

"Direct Extraction - Pycnometer Method for Oil Content of Refinery Effluents," by W. S. Levine, G. S. Mapes and M. J. Roddy, Socony-Vacuum Laboratories Technical Service Dept., Brooklyn, N. Y.

A new method for determining how much oily material is suspended or dissolved in refinery waste waters is described. It is rapid, accurate, and especially useful when the waste water contains appreciable amounts of volatile material such as gasoline or kerosine. The oil in a sample of water is extracted with carbon tetrachloride, the extract transferred to an especially designed specific-gravity bottle called a pycnometer, and weighed. From the difference in weight between the solution of oil in the carbon tetrachloride and the equal volume of pure solvent, the oil content of the water sample can be calculated.

This paper also summarizes the various methods developed for making this determination, the factors which affect its accuracy, and the precautions which need to be observed for the best results. Although the method is designed to find the total quantity of oil in a given sample, it can, by a simple modification, be used to determine how much volatile oil and non-volatile oil are present in a sample of effluent water.

Dr. Levine

Mr. Mapes

Mr. Roddy

Hydrocarbons and Phenols In Refinery Effluent

"Methods for Determining Hydrocarbons and Phenols in Refinery Effluent Waters," by C. E. Headington, Atlantic Refining Co., Philadelphia, Pa.

A Report of the Subcommittee on Refinery Effluent-Water Analytical Methods, of the Committee on Analytical Research of the API's Division of Refining.

Working cooperatively through the American Petroleum Institute, a group of petroleum laboratories has devised methods for finding as little as a few parts of oil in a billion parts of water. This would be equal to one drop of oil in 250 bbl. of water.

To Help You Design Fractionators

2 in a series—Stripping and rectifying of ternary mixtures—partially distributed components

By ROBERT R. WHITE
Dept. of Chemical and Metallurgical Engrg.
University of Michigan

THE preceding article of this series[5] dealt with stripping and rectifying ternary systems when the separation was specified so as to insure that all of the components were present in the product, i.e. in a stripping operation the concentration of the most volatile component was specified in the bottom product and in a rectifying operation the concentration of the least volatile component was specified in the distillate product. This article completes the discussion of stage calculations at finite reboil and reflux ratios and considers the cases which arise when other methods of specifying the separation are employed.

Consider the stripping of a ternary saturated liquid feed stream to produce from a stripping column (Fig. 1, Ref. 5) a bottom product which contains x_{cB} mole fraction of the least volatile component. When the equilibrium tie line originating at the point F representing the feed stream intersects the specification line as shown in Fig. 1, the relationship between the reboil ratio, product composition, and stage requirement is similar in all respects to the case where x_{aB} was specified. As shown previously, as the reboil ratio is decreased, the bottom product shifts from the composition represented by the point B_f at total reboil ratio and minimum stages to the point B_∞ at the minimum reboil ratio and infinite stages, the point B_∞ being established by the intersection with the specification locus of the extrapolation of equilibrium tie line originating at the feed point F. The infinite stage zone at the minimum reboil ratio occurs at the feed stage.

If the concentration of component c in the bottom product, x_{cB}, is increased, the equilibrium tie line originating at the point F may intersect the specification locus at the base of the ternary diagram, as shown in Fig. 2 by the point B_∞. In this case, as the reboil ratio is reduced from infinity (total reboil ratio) to its minimum value, a zone of constant composition and infinite stages develops at the feed stage as before in Fig. 1. But, in addition, another zone of constant composition, designated by the points L_∞ and V_∞, containing infinite stages develops along the base representing a binary mixture of b and c. The minimum reboil ratio, $(V_\infty/B)_{min}$ again is equal to the relative distance $FB_\infty/FV_{1,\infty}$.

The compositions in the binary zone of constant composition, L_∞ and V_∞, may be calculated from the composition of the bottom product B_∞ and the minimum reboil ratio by familiar methods of binary distillation.

The fractionation from the binary zone of constant composition $L_\infty V_\infty$ to the ternary zone of constant composition $FV_{1,\infty}$ occurs along the lines $L_\infty F$ and $V_{1,\infty}V_\infty$. These lines are straight and parallel in systems of constant molal overflow and constant relative volatility. The straight and parallel relationship follows from the fact that in a system of constant relative volatility when the vapor ends of any two tie lines are connected by a straight line, such as $V_\infty V_{1,\infty}$ in Fig. 2, the line constitutes the locus of the ends of all tie lines originating on the straight line drawn between the liquid ends of the two tie lines, such as FL_∞ in Fig. 2. Further, where constant molal overflow conditions occur, the reboil ratio $V_\infty B$ represented by the relative distance $\frac{FB_\infty}{V_{1,\infty}F}$, $\frac{L_\infty B_\infty}{V_\infty L_\infty}$ or in general $\frac{LB_\infty}{LV}$, is a constant. This requires that the points L and V representing the liquid and vapor passing between any two stages fall on parallel lines.

Putting the argument in a negative sense, if a point V_n representing a vapor in the column did not fall on the line $V_\infty V_{1,\infty}$, its equilibrium liquid, L_n could not lie on the line FL_∞, since FL_∞ is the locus of all equilibrium tie lines terminating at $V_\infty V_{1,\infty}$. If the equilibrium liquid L_n does not lie on the line FL_∞, then the vapor rising from next stage, V_{n+1}, cannot lie on the line $V_\infty V_{1,\infty}$ since the relative distance $BL_n/V_{n+1}L_n = V_\infty/B$ and the lines FL_∞ and V_1V_∞ are so located as to produce this relationship for liquids and vapor represented by points thereon. Therefore, it is impossible to reach either the binary zone $L_\infty V_\infty$ or the ternary zone $FV_{1,\infty}$ from a vapor that does not lie on the line $V_{1,\infty}V_\infty$.

The straight, parallel relationship may also be established mathematically, by the following relations developed by Underwood.[1-4] For a component of a mixture of N components in a stripping column, material balances around the bottom of the column and between stages m and $m+1$ give

$$L = V + B \tag{1}$$

$$Vy_{i,m+1} = Lx_{i,m} - Bx_{i,B} \tag{2}$$

$$y_{i,m+1} = \frac{L}{V}x_{i,m} + \left(1 - \frac{L}{V}\right)x_{i,B} \tag{3}$$

Also

$$y_{i,m+1} = \frac{\alpha_i x_{i,m+1}}{\Sigma \alpha x_{m+1}} \tag{4}$$

Substituting the expression for $y_{i,m+1}$ given by Equation 4 in Equation 3

$$\frac{\alpha_i x_{i,m+1}}{\Sigma \alpha x_{m+1}} = \frac{L}{V}x_{i,m} + \left(1 - \frac{L}{V}\right)x_{i,B} \tag{5}$$

Multiplying both sides of Equation 5 by the expression $\alpha i/\alpha_i - \psi$ where ψ is an arbitrary function

$$\left(\frac{\alpha_i}{\alpha_i - \psi}\right)\left(\frac{\alpha_i x_{i,m+1}}{\Sigma \alpha x_{m+1}}\right) = \frac{L}{V}\left(\frac{\alpha_i x_{i,m}}{\alpha_i - \psi}\right) + \left(1 \frac{L}{V}\right)\left(\frac{\alpha_i x_{i,B}}{\alpha_i - \psi}\right) \tag{6}$$

There are N Equations 6, one for each component. If these are all added together

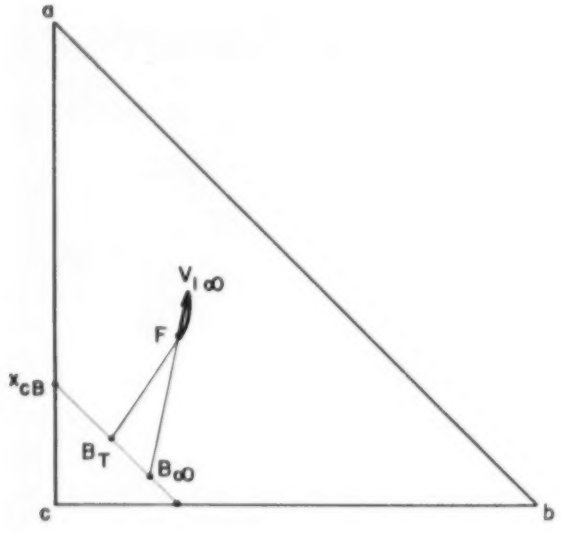


FIG. 1

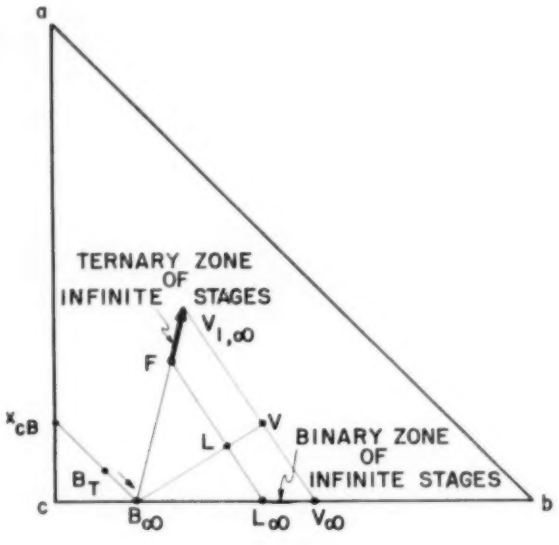


FIG. 2

$$\sum \left(\frac{\alpha_i}{\alpha_i - \psi}\right)\left(\frac{\alpha_i x_{i,m+1}}{\Sigma \alpha x_{m+1}}\right) = \frac{L}{V}\sum\left(\frac{\alpha_i x_{i,m}}{\alpha_i - \psi}\right) + \left(1 - \frac{L}{V}\right)\sum\left(\frac{\alpha_i x_{i,B}}{\alpha_i - \psi}\right) \quad (7)$$

Now define the arbitrary function ψ by

$$\left(1 - \frac{L}{V}\right)\sum\left(\frac{\alpha_i x_{i,B}}{\alpha_i - \psi}\right) = 1.0 \quad (8)$$

Then

$$\frac{L}{V}\sum\frac{\alpha_i x_{im}}{\alpha_i - \psi} = \sum\left(\frac{\alpha_i}{\alpha_i - \psi}\right)\left(\frac{\alpha_i x_{i,m+1}}{\Sigma \alpha x_{m+1}}\right) - 1 = \frac{1}{\Sigma \alpha x_{m+1}}\sum\left[\left(\alpha_i x_{i,m+1}\right)\left(\frac{\alpha_i}{\alpha_i - \psi}\right) - \alpha_i x_{i,m+1}\right] = \frac{\psi}{\Sigma \alpha x_{m+1}}\sum\left(\frac{\alpha_i x_{i,m+1}}{\alpha_i - \psi}\right) \quad (9)$$

and Equaton 7 becomes

$$\sum \frac{\alpha_i x_{i,m}}{\alpha_i - \psi} = \frac{\psi/(V/L)}{\Sigma \alpha x_{m+1}}\sum \frac{\alpha_i x_{i,m+1}}{\alpha_i - \psi} \quad (10)$$

Equation 8 will give as many values of ψ as there are components so that there are N Equations 10 corresponding to the various values of ψ. In general, each term of the summation establishes one solution for ψ so that for a ternary mixture

$$\alpha_c = 1 < \psi_c < \alpha_b$$

$$\alpha_b < \psi_b < \alpha_a$$

$$\alpha_a < \psi_a$$

Each term of the summation establishes the value for ψ that is larger than the relative volatility, α, corresponding to that term, but is less than the α for the next most volatile component.

Now writing Equation 10 for any two components k and j and dividing

$$\frac{\sum \frac{\alpha_i x_{i,m}}{\alpha_i - \psi_k}}{\sum \frac{\alpha_i x_{i,m}}{\alpha_i - \psi_j}} = \frac{\psi_k}{\psi_j}\frac{\sum \frac{\alpha_i x_{i,m+1}}{\alpha_i - \psi_k}}{\sum \frac{\alpha_i x_{i,m+1}}{\alpha_i - \psi_j}} \quad (11)$$

Applying Equation 11 to successive stages relates the composition on stage o to that on stage m

$$\frac{\sum \frac{\alpha_i x_{i,o}}{\alpha_i - \psi_k}}{\sum \frac{\alpha_i x_{i,o}}{\alpha_i - \psi_j}} = \left(\frac{\psi_k}{\psi_j}\right)^m \frac{\sum \frac{\alpha_i x_{i,m}}{\alpha_i - \psi_k}}{\sum \frac{\alpha_i x_{i,m}}{\alpha_i - \psi_j}} \quad (12)$$

There are $N - 1$ *independent* Equations 12 and if all of the values of x_o are known, these equations may be solved simultaneously with $\Sigma x_{i,m} = 1.0$ to give the value of x_m at any value of m, or conversely if the x_m values are known, the x_o values may be calculated.

Underwood[1-4] presents a more elegant procedure for this calculation by using relationships that depend upon various compositions in infinite stage zones.

At infinite stages where $x_m = x_{m+1} = x_\infty$ Equations 5 and 10 give

$$\psi = \frac{L}{V}\Sigma \alpha_i x_{i,\infty} \quad (13)$$

and

$$x_{i,\infty} = \frac{\psi\left(1 - \frac{L}{V}\right)x_{iB}}{\frac{L}{V}(\alpha_i - \psi)} \quad (14)$$

Writing Equation 14 for the intermediate component and substituting Equation 13

$$x_{b,\infty} = \frac{\left(1 - \frac{L}{V}\right)x_{bB}}{\frac{\alpha_b}{\Sigma \alpha_i x_i} - \frac{L}{V}} \quad (15)$$

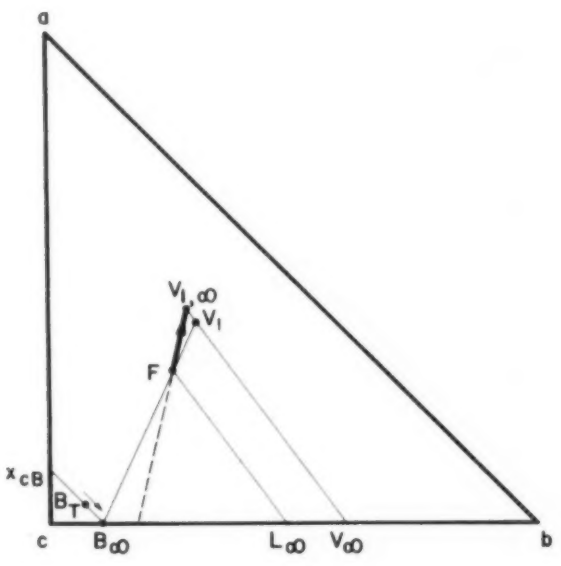


FIG. 3

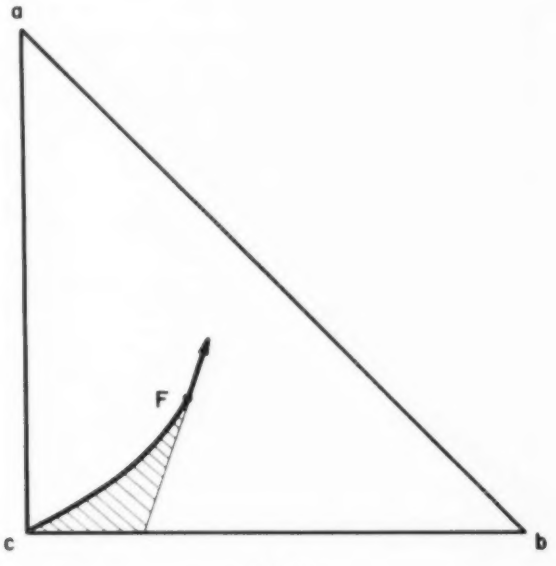


FIG. 4

Since $\frac{a_b}{\sum a_j x_{j,\infty}} \frac{y_{b,\infty}}{x_{b,\infty}}$, Equation 15 may be rearranged to give

$$\frac{L}{V} = \frac{x_{bB} - y_{b,\infty}}{x_{bB} - x_{b,\infty}} \quad (16)$$

However, L/V is also equal to the relative distance $\frac{BV_{a,1,\infty}}{BF}$ which is in turn equal to $\frac{y_{a,1,\infty}}{x_{aF}}$. Substituting this expression for L/V in Equation 16 and rearranging gives

$$\frac{y_{a,1,\infty}}{x_{aF}} = \frac{x_{bB} - y_{b,\infty}}{x_{bB} - x_{b,\infty}} \quad (17)$$

Equation 17 may be written in terms of distances as

$$\frac{\overline{BV}_{1,\infty}}{\overline{BF}} = \frac{\overline{BV}_\infty}{\overline{BL}_\infty} \quad (18)$$

Equation 18 shows that the triangles $\overline{BFL}_\infty$ and $BV_{1,\infty}V_\infty$ are similar and therefore the lines FL_∞ and $V_{1,\infty}V_\infty$ are parallel.

The two lines FL_∞ and $V_\infty V_{1,\infty}$ represent a unique path of fractionation through which all *binary* bottom products are fractionated at the minimum reboil ratio regardless of how the bottom product is specified, this unique path being fixed only by the properties of the feed stream.

Where the tie line from the feed point F intersects the specification line outside the ternary diagram as shown in Fig. 3, the bottom product can shift with decreasing reboil ratio only until the point B reaches the binary base at which x_{cB} becomes zero. At the minimum reboil ratio, the zone of infinite stages is again $L_\infty V_\infty$, the same composition as in Fig. 2 for the same feed stream, the value of the minimum reboil ratio being $\frac{L_\infty B}{V_\infty L_\infty}$. In this case the overhead vapor product is represented by the point V_1 at the intersection of the line $B_\infty F$ with the line $V_{1,\infty}V_\infty$.

The cross hatched area in Fig. 4 represents all of the possible bottom products which can be produced in a stripping column from a saturated liquid feed represented by the point F.

The specification of the concentration of the component of intermediate volatility in the bottom product, x_{bB}, may present some additional complication although basically the relationship between reboil ratio and product composition follows the patterns established in the previous cases. This relationship is illustrated in Fig. 5.

At a bottom product specification of x_{bB}, the bottom product shifts from B_T to B_∞ as previously described, the binary zone of constant composition developing at $L_\infty V_\infty$. At a bottom product specification x_{bB1}, the bottom product composition at total reboil ratio and minimum stages is represented by the point B_{T1}. As the reboil ratio is decreased from infinity, the bottom product may shift either upwards to the point $\overline{B}_{\infty,1}$ with a ternary zone of infinite stages developing at a reboil ratio equal to $FB_\infty/FV_{1,\infty}$, at the feed stage, or the bottom product may also shift downwards to $B_{\infty,1}$ producing a binary zone of constant composition at a reboil ratio equal to $\frac{L_\infty \overline{B}_{\infty,1}}{L_\infty V_\infty}$, the latter reboil ratio (infinite stages) being considerably larger than the former value. There is therefore the curious situation of having two values of reboil ratio with infinite stages and bottom product composition, each from the same feed stream and meeting the same specifications.

With a bottom product specification $x_{bB'}$, there are two bottom products at total reboil ratio which meet the specifications, represented in Fig. 5 by the points labelled B_T' and two bottom products B_∞' at two different reboil ratios requiring infinite stages, one leading to a ternary zone of constant composition at the feed

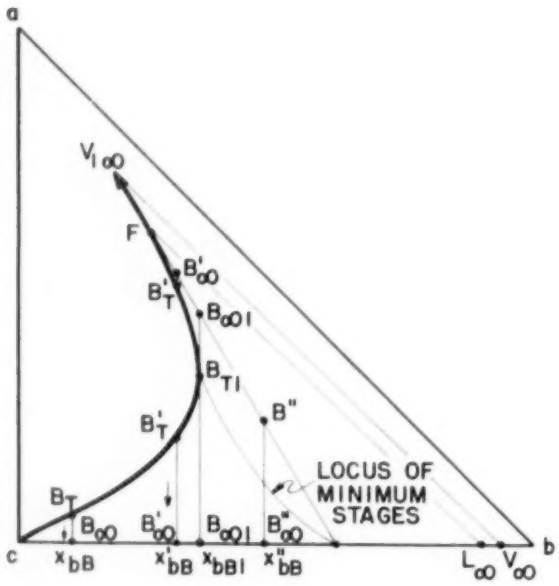


FIG. 5

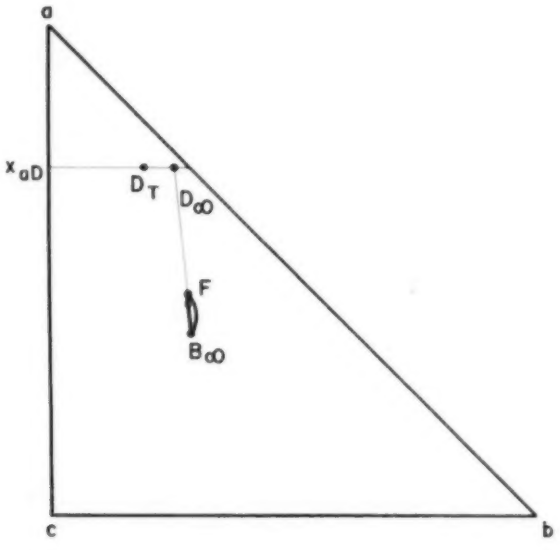


FIG. 6

stage and the other to a binary zone of constant composition.

Even more unusual is the case where the bottom product specification is x_{bB}". Here the specification cannot be met at infinite reboil ratio but only at some maximum finite value giving a product such as B". Again, as the reboil ratio is decreased from its maximum value, the bottom product composition may shift either upwards or downwards to B_∞" at different values of the reboil ratio each requiring an infinite number of stages.

Recapitulating the general characteristics of stripping columns with ternary mixtures:

1—The overhead vapor composition is a function of the reboil ratio.

2—The bottom product composition is a function of the reboil ratio.

3—The value of the minimum reboil ratio is a function of the separation specified and the manner of specification.

4—The composition of the liquid and vapor in the zone of constant composition at the minimum reboil ratio is a function only of the feed properties and is dependent on the separation specified only with respect to whether a ternary zone of constant composition and infinite stages develops at the feed stage, or a binary zone of constant composition and infinite stages develops in the middle of the column.

Rectifying columns (Fig. 7, Ref. 5) are governed by the same relationships as stripping, as indicated by Figs. 6, 7 and 8.

In Fig. 6, since the tie line terminating at point F, representing the feed, in this case as saturated vapor, intersects the locus specifying a fixed concentration of the most volatile component in the distillate product, the distillate product composition shifts from D_T at total reflux to D_∞ at the minimum reflux ratio, the point D_∞ lying on the extrapolated tie line and the ratio, R/D, being equal to the relative distance $\frac{D_\infty F}{FB_\infty}$.

In Fig. 7, the tie line terminating at F intersects the specification locus, x_{aD}, at the binary base $a - b$ so that at minimum reflux ratio, there is not only a ternary zone of infinite stages at the feed stage but also a binary zone of infinite stages $L_\infty V_\infty$. Fig. 8 is analogous to Fig. 2 for stripping columns.

In Fig. 8, the tie line does not intersect the specification locus so that at minimum reflux ratio the same binary zone of infinite stages develops as in Fig. 7 but there is no ternary zone of infinite stages.

Example Problem

A saturated vapor feed material containing 35 mole % "a", 35 mole % "b" and 30 mole % "c" having relative volatilities of, 2.0, 1.5 and 1.0 respectively is to be rectified to produce a distillate product containing 90 mole % "a". What is the minimum reflux ratio?

Solution:

1—The first step is to locate the tie line terminating at the point F and originating at point B' in Fig. 8.

$$x_{aB}' = \frac{y_a/\alpha_a}{y_a/\alpha_a + y_b/\alpha_b + y_c/\alpha_c} = \frac{0.35/2.0}{0.35/2.0 + 0.35/1.5 + 9.30/1.0} = 0.247$$

$$x_{bB}' = \frac{y_b/\alpha_b}{y_a/\alpha_a + y_b/\alpha_b + y_c/\alpha_c} = \frac{0.35/1.5}{0.35/2.0 + 0.35/1.5 + 0.30/1.0} = 0.329$$

$$x_{cB}' = \frac{y_c/\alpha_c}{y_a/\alpha_a + y_b/\alpha_b + y_c/\alpha_c} = \frac{0.30/1.0}{0.35/2.0 + 0.35/1.5 + 0.30/1.0} = 0.424$$

1.000

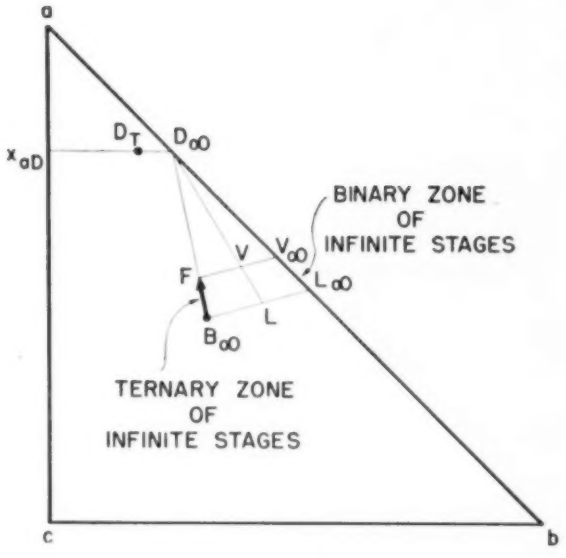


FIG. 7

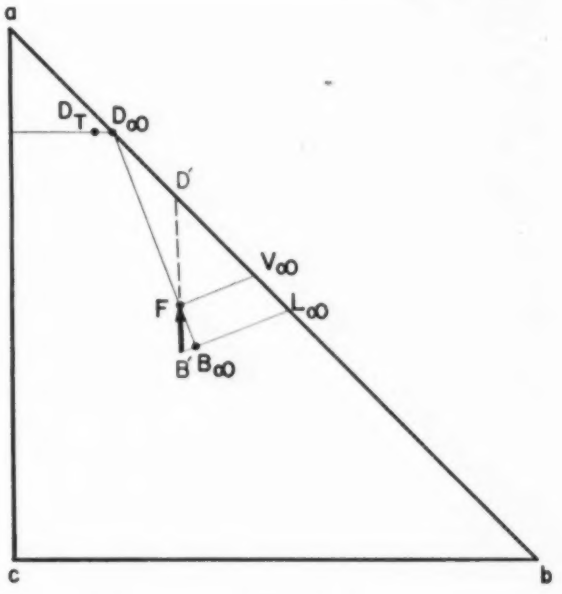


FIG. 8

2—The second step is to locate the intersection of the feed tie line with the binary base. From the straight line $D'FB'$

$$\frac{y_{aF} - x_{aB'}}{y_{cF} - x_{cB'}} = \frac{x_{aD'} - y_{aF}}{x_{cD'} - y_{cF}} \qquad (19)$$

From which

$$x_{aD'} = y_{aF} + (x_{cD'} - y_{cF}) \left[\frac{y_{aF} - x_{aB'}}{y_{cF} - x_{cB'}} \right]$$

Since $x_{cD'} = 0$

$$x_{aD'} = 0.35 + \frac{0.35 - 0.247}{0.30 - 0.424} 0.0 - 0.30$$

$$= 0.599$$

$$x_{bD'} = 0.401$$

$$x_{cD'} = 0.000$$

$$1.000$$

Thus, if the distillate product specification had been $x_{aD} = 0.599$ the binary zone of infinite stages would have occurred simultaneously with a ternary zone of infinite stages. At all specifications $x_aD > 0.599$ only the binary zone occurs at minimum reflux.

3—The third step is to compute the composition in the binary zone. If the specification had been $x_{aD} = 0.599$ the minimum value of L/V would have been

$$(L/V) = \frac{D'F}{D'B'} = \frac{y_{cF} - x_{cD}}{x_{cB'} - x_{cD}} = \frac{0.30 - 0}{0.424 - 0} = 0.708$$

By material balances around the top of the column and between stages n and $n + 1$, for any component

$$y_{n+1} = \frac{L}{V} x_n + \left(1 - \frac{L}{V} \right) x_o \qquad (20)$$

and since at equilibrium $y_i = K_i x_i = K_r a_i x_i$ where K_r is the equilibrium volatility constant for the reference component r.

$$a_i K_r x_{i,n+1} = \frac{L}{V} x_{i,n} + \left(1 - \frac{L}{V} \right) x_{iD} \qquad (21)$$

In a zone of infinite stages $x_{i,n+1} = x_{i,n} = x_{i,\infty}$ and

$$x_{i,\infty} = \frac{(1 - L/V)\, x_{iD}}{a_i K_r - L/V} \qquad (22)$$

and

$$\Sigma x_{i,\infty} = 1.0 = \left(1 - \frac{L}{V} \right) \frac{x_{iD}}{a_i K_r - L/V} \qquad (23)$$

Equation 22 may be solved for any L/V by determining by trial and error the value of K_r that satisfies the summation. The final calculation for this case is shown in the following table where $K_r = 0.595$.

Comp.	$x_{D'}$	$\left(1 - \frac{L}{V}\right) x_{D'}$	a	aK_r	$\frac{L}{V}$	$x_{i,\infty}$	$y_{i,\infty}$
a	0.599	0.175	2.0	0.482		0.363	0.433
b	0.401	0.117	1.5	0.1845		0.635	0.567
						0.998	

4—Knowing the composition of the binary zone of infinite stages (Columns 6 and 7) permits immediate calculation of the minimum reflux ratio since

$$(R/D)_{min} = \frac{D_r L_r}{L_r V_r} = \frac{x_{aD} - x_{a,\infty}}{y_{a,\infty} - x_{a,\infty}} = \frac{0.90 - 0.363}{0.433 - 0.363}$$

$$= 7.68$$

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(3) Underwood, A. J. V., *J. Inst. Petroleum*, 32, 614 (1946).
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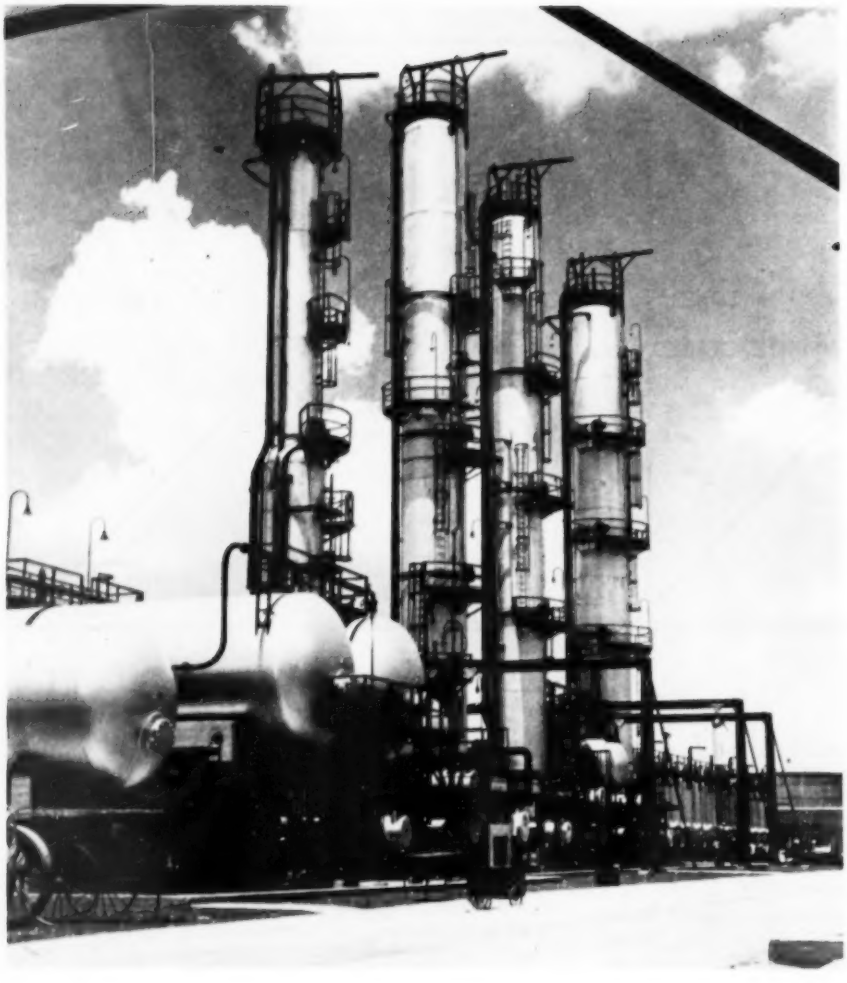


GOOD HOUSEKEEPING south of the border is very much in evidence in this view at Atzcapotzalco of the hydrocarbon separation unit, which prepares feed for isomerization and alkylation. Shown, l to r: charge tanks, depropanizer, debutanizer, deisobutanizer and deisopentanizer

Refining in Mexico—Part 3

How Pemex Operates a Refinery

- Bottleneck Surgery Gives High Operating Rates
- Advance Planning Is Keynote in Maintenance
- Product Testing Is Independent of Operations

By D. P. THORNTON, Jr.
Southwestern Editor

THE refinery at Atzcapotzalco, near Mexico City, carries on the most extensive processing operations of the eight present plants of Petroleos Mexicanos (Pemex), the government-owned, single oil company in Mexico. It is their "showplace", because of ready accessibility to visitors.

At first a 17,000 b/d plant, it was expanded in 1947 to approximately 40,000 b/d by the installation of additional topping facilities, alkylation and the like. The present facilities are rated at 52,000 b/d and are currently operating at 48,500 b/sd.

This revamped and modernized refinery has been described in some detail by Mena, Guerreri and Wilson[1] although at that time construction was not completed. Discussion here will be confined to changes, unusual aspects in processing or equipment, and the way in which the various products are blended.

Atzcapotzalco is an excellent example of the modern refinery of Mexico and need not bow its head even to plants in the U. S., in the matter of good housekeeping, working conditions and the state of repair of its equipment.

The removal of bottlenecks in equipment and operating units has been principally responsible for the high rate of operations achieved. Throughput is limited at present to

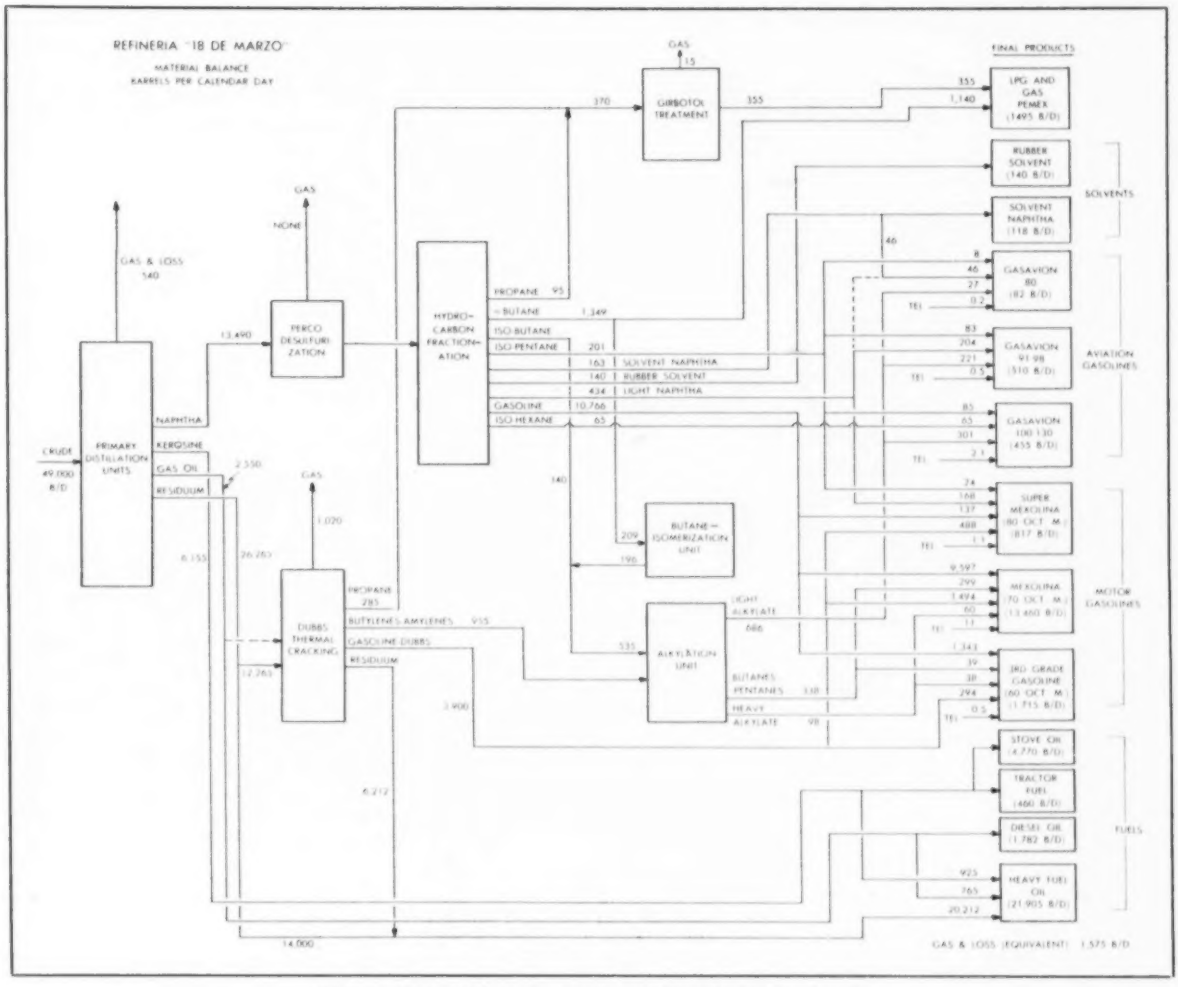


FIG. 1—Material balance for the "18th of March" refinery, based on present operating throughput of 49,000 B/D

the capacity of the crude line from Poza Rica.

As an example of what has been done, the McKee topping unit built in 1947 was designed for 24,000 b/d of stabilized crude and with enriched crude actually charges a normal 30,000 b/d. By "crowding", this unit has processed 35,000 bbls.

The old Braun and Badger topping units, the only original equipment still standing in the plant, now have respective capacities of 10,000 and 14,000 b/d. Their capacities were recently increased by larger piping and other bottleneck surgery. The capacity of the two units soon will be increased 2000 b/d more by the installation of new heaters. A combined control room is under construction.

Newest processing unit at Atzcapotzalco, installed last summer, is a 12,000 b/d (nominal) Perco catalytic desulfurization unit. This already has been responsible for an increase in the clear octane rating of straight-run gasoline and a considerable reduction in tetraethyl lead consumption.

Atzcapotzalco is unusual in that it is almost totally electrified. Only services most vital to uninterrupted operation are provided with steam-driven spares, while the steam needs of the refinery have been kept as low as possible to conserve all fuel oils for sale to industry. Plant fuel is natural gas from Poza Rica.

Table 1—Inspection of Principal Crude Charged at Atzcapotzalco

	Enriched Poza Rica Crude	New Texistepec Crude*
Gravity, °API	33.35	Below 25
Sulfur, %	1.6	2.90
Salt, lbs/1000 bbls.	25.60	...
Distillation, Vol.-%:		
Gasoline 375-400 ep.	27.03	14.0
Kerosine	14.37	9.0
Gasoil	11.37	2.0
Reduced Crude	47.07	75.0**

* Operating experience when charging this crude not available, although preparations were under way for its anticipated use beginning in early October, 1952, in addition to the enriched crude.

** Heavy fuel 300 Furol vis. @ 122° F.

The approximately 49,000 b/d charge currently consists of 41,000 bbls. of topped Poza Rica crude, 3200 bbls. straight-run gasoline from stabilization operations at Poza Rica, and 4000 bbls. of 30-lb. Reid vapor pressure natural gasoline. An inspection of this enriched crude is shown in Table 1, which also gives data on another crude which it is anticipated will soon be available to Atzcapotzalco.

The refinery operating scheme is shown in Fig. 1 as a block diagram. It will be noted that catalytic desulfurization normally is used only for treating straight-run gasoline. This unit is able to process 15,000 b/d.

The quantities shown in the diagram are based on tank gages, not calculations. They reflect mechanical losses and some obvious discrepancies will be discernible; also not taken into account in the operating

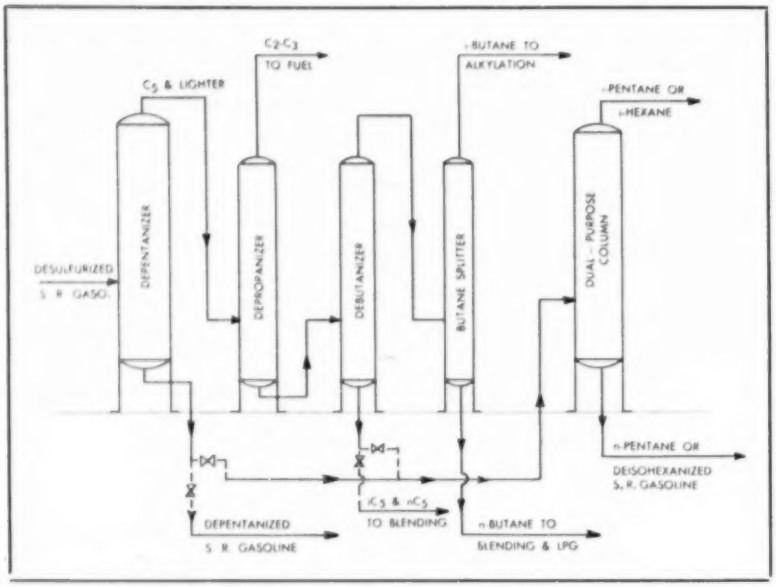


FIG. 2—The light ends fractionating unit splits butanes, pentanes, and hexanes from unstabilized straight-run gasoline

balance are excesses accumulated in storage to compensate for unbalance, periods when one or more units may be down for maintenance.

The effect of catalytic desulfurization on the quality of refined products is better illustrated by the data of Table 2, which shows octane ratings obtained with varying quantities of tetraethyl lead. Note that 0.5cc. TEL yields a product having almost the same octane rating which requires 3.0 cc. TEL to effect in the undesulfurized stock. The lead saving for the overall finished gasoline blends is by no means as great, however, due to incorporation of thermally cracked gasoline and other hydrocarbon fractions in these materials.

Catalytic desulfurization now has straight-run gasoline fractions. The copper sweetening equipment is being converted to sweetening kerosine, to permit eventual scrapping of present Doctor sweetening equipment. This step will improve the quality of stove kerosine and tractor fuel, particularly.

There is another effect on the refinery hydrocarbon balance which is not apparent from Fig. 1 or Table 2, which simply infer lead saving to be the only result of desulfurization. This develops from the fact that, until this installation was completed, it was necessary to use some light alkylate isohexane, too (when it could be spared) in meeting the octane requirements for 80 octane aviation gasoline and Super Mexolina. No alkylate is used now in motor fuel, very little in 80 octane avgas (a small-volume product) so that the major portion of this expensive component is held for 100-130 avgas.

Light Ends Fractionation

Extensive splitting out of light hydrocarbons is indicated in Fig. 1 H_2S produced in catalytic desulfurization is removed with the propane and subsequently discarded in the tail gas from the Girbotol unit (monoethanolamine). The equipment is highly flexible, so that high-octane fractions may be segregated for alkylation, isomerization, gasoline blending and LPG production. The flow scheme as presently used is shown in Fig. 2.

In normal operation, pentanes and lighter are taken overhead from the first tower, which receives the full-straight-run production. Base motor fuel stock is the bottom product. The overhead product then is depropanized, sweetened, and successively debutanized and dependentanized. The butanes are split into isobutane for alkylation with the normal butane bottoms going to blending, isomerization or as LPG. Plant needs require but 213 b/d of isopentane, whereas the deisopentanizer has capacity to charge 2275 b/d, thereby producing 630 b/d of isopentane. This requires the tower to be in operation but 10 to 11 days a month. There also is a substantial quantity of isohexane present in the straight-run naphtha, material which can be used to advantage in blending 100-130 octane aviation gasoline. The amount which could be utilized is approximately 76 b/d at maximum capacity. In blocked operation, the deisopentanizer can charge dependentanized gasoline and produce on the order of 235 b/d of isohexane. This will satisfy isohexane needs in another ten days' operation. During the remaining nine days the deisopentanizer is utilized in making solvents and special cuts.

Table 2—Effects of Catalytically Desulfurizing Light Straight-Run Naphtha from Poza Rica Crude

	Octane Rating, Motor Method	
	Charge Stock	Catalytically Desulfurized*
Clear	41.7	61.1
+ 0.5 cc. TEL	57.1	69.7
+ 1.0 cc. TEL	59.5	75.5
+ 1.5 cc. TEL	62.1	79.2
+ 2.0 cc. TEL	65.6	82.3
+ 3.0 cc. TEL	70.0	84.6
+ 4.0 cc. TEL	73.5	86.4
Sulfur, %	0.07	0.01

*Inlet temperature 915° F.

Rubber solvent is produced by a side stream from the main crude tower of the Badger topping unit and is included in the light ends fractionation unit merely for convenience.

The butane isomerization unit (Shell liquid phase) has been previously described [1] and is operated conventionally. However, from its 905 b/d charge it produces 55% isobutane in the effluent; at a charge rate of 1103 b/d, the effluent will be 45% isobutane. Charging 565 b/d of n-pentane, the unit is designed to produce 90% pure isopentane at the rate of 500 b/d but never has been operated in this manner.

During 1951 the isomerization unit charged 471,050 bbls. of n-butane, producing 116,500 bbls. of i-butane. It consumed 0.117 lbs. of hydrochloric acid per bbl. of i-butane produced. Consumptions of other raw materials per bbl. of i-butane produced were: 0.48. lbs. of aluminum chloride, 0.17 lbs. of antimony trichloride and 0.18 lb. of sodium hydroxide.

At least a third less aluminum chloride will be consumed in 1952 on the basis of present records, while the antimony salt will drop to 0.09 lb. per bbl. i-butane. The 1951 figures cited above are misleading in that the chemicals had been in storage for four years, their quality had deteriorated and larger amounts were used than would be required with fresher chemicals. Future purchases will be at six-month intervals.

HF Alkylation

The HF alkylation unit at Atzcapotzalco is rated to produce 813 b/d of light alkylate, charging mixed butylenes and amylenes from thermal cracking. Under these conditions the charge consists of 651 b/d i-butane and 1026 b/d of olefins. Other products from this unit include 16.6 b/d heavy alkylate, 108.3 b/d propane and 539.8 b/d mixed n-butane and pentanes.

In 1951 this unit had an on-stream efficiency of 97.3% and produced 220,800 bbls. of light alkylate. The ratio of olefins charged to total alkylate produced was 1.61; light al-

kylate to olefins, 1.46, and isobutane to olefins, 1.15. It consumed 1.10 lb. of hydrofluoric acid per bbl. of light alkylate.

The principal change which has been made in operation of the alkylation unit involved removal of the agitators in the contactors. The bottom of the vessel now admits the mixture of i-butane and acid followed by injection of the olefin into the stream. So far as reported the change has had no effect on alkylate production or quality, and indications are that acid consumption will increase little, if at all.

The elimination of the agitators was based on maintenance requirements, but also saves steam formerly used for power.

The Dubbs unit ran only 319 days in 1951 for an onstream efficiency of 87.4%. During this period it charged 4,346,704 bbls. of topped crude, produced 31.68% cracked gasoline, 51.68% residuum, 7.95% olefins and 8.69% gas and loss. It was shut down three times for normal maintenance plus considerable revamping work and averaged slightly more than 100 on-stream days per operating period.

The Braun unit topped crude 95.3% of the time last year, charging 3,261,841 bbls. of crude. Revamping work has been started, to eliminate minor operating bottlenecks and to relocate control instruments on a common panel with the adjacent Badger topping unit.

The Badger unit operated 92% of the time, requiring extensive repairs in 1951. It charged 4,276,882 bbls. of crude. The McKee unit operated 97.7% of the time and charged 9,897,581 bbls. Total crude topped at Atzcapotzalco in 1951 was 17,436,304 bbls.

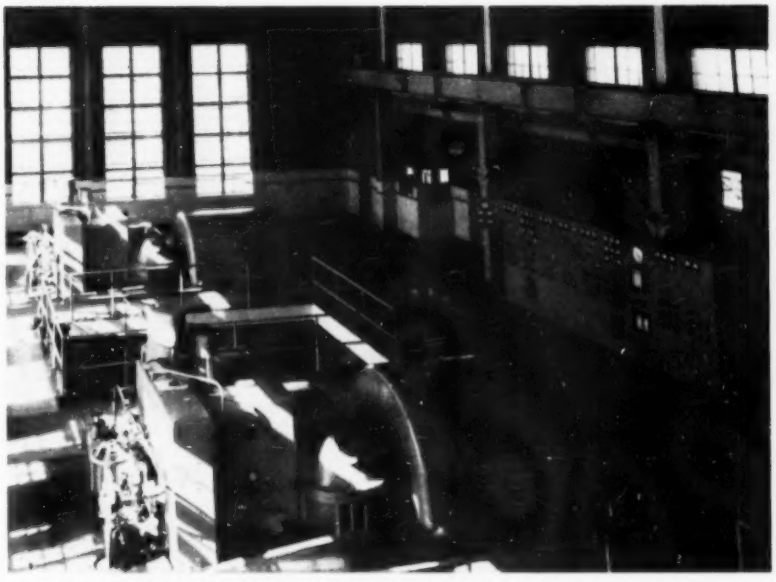
Normal turnaround time reported for the McKee unit, which is rather large, is but 48 hours; for the Dubbs thermal cracker, four days. As in this country, tunrarounds are scheduled well in advance. They are carefully planned and directed by the Department of Inspection and Security (security in this case is synonymous with "safety" and comes from "security" of equipment as well as personnel.)

Advance Maintenance Planning

Advance planning of maintenance work is of extreme importance at this Pemex refinery. Because most equipment is not made in Mexico, the additional time required for shipment must be allowed. The Arthur G. McKee Co., builders of most of the units at Atzcapotzalco and now engaged in extensive construction work at Poza Rica and Salamanca, handles much of the expediting work of Pemex in the U. S.

Consequently, the general practice at Atzcapotzalco and other Pemex refineries is to keep on hand all necessary supplies for at least three months ahead; more for certain vital items having longer fabrication times. A perpetual minimum and maximum inventory system is used. In emergencies, air freight is employed to get equipment on the spot promptly. Just as in U. S. plants, planning is kept far enough ahead of scheduled shut downs so that fabrication or repair of "spare" equipment can be completed and ready in advance of the actual turnaround.

Maintenance and turnaround work is carried out by plant personnel. There are no organizations with trained personnel outside the refinery to turn to, as in the U. S. In general, plant personnel are excellent mechanics. They are craftmen, taking great pride in their work. The individual is proud of his pump, tools, or whatever he works with. They can and do perform intricate jobs with or without machine tools.



MODERN POWERHOUSE at Atzcapotzalco has two 5000 KW generators, with room for another one

Refining in Mexico

For seven weeks, Dave Thornton probed and poked around the refineries in Mexico, looking at equipment, checking records, and talking with managers and operators alike. This series is the result. Article 1 appeared in February, pp. 217-227, and described the organization of Petroleos Mexicanos and how Mexico's economics affect petroleum operations there. Article 2 appeared in March, pp. 373-376 and pp. 389-391, and described the facilities at Poza Rica. The present article covers operations at Atzcapotzalco, near Mexico City.

Safety and Fire Prevention

Adequate protection in modern form is provided for men who must work in potentially hazardous locations. The appropriate burning permits, inspections before men enter vessels or tanks, and non-spark tools are utilized where advisable. Electric equipment conforms to Class 1 Group D requirements and for the most part was purchased in the U. S. Appropriate clothing is provided for men working at the alkylation and isomerization units and the lead-blending plant.

The experience record at the alkylation plant shows no fatalities or major injuries. The few minor injuries have been the consequence of failure to observe safety regulations or use the protective clothing available. This record compares favorably with experience of the Phillips Petroleum Co.[2] in this country, designers of the unit used.

First aid facilities are provided at the plants. Although not applying specifically to Atzcapotzalco, which is located in an area where the best medical attention to be had in Mexico is readily available, Pemex provides these services when adequate medical facilities are not otherwise to be had. This even goes as far as construction and staffing of modern hospitals (as at Poza Rica, for example), both to care for on-the-job casualties and "personal" illnesses of employes and their families.

One fire-prevention arrangement found at Atzcapotzalco is particu-

NEW DUTIES, SAME UNITS—these copper chloride treaters are now used for kerosine, formerly were in gasoline service

larly out-standing among the normal conventional arrangements utilizing water fog and foam. This is the steam curtain installed about the boiler area. Here the boilers are centrally located within the plant. This saves on piping but positions the area so that operating units are located on two sides while a major in-plant storage area is on another. The main transfer pumphouse is across the street. This arrangement could not have been avoided without great expense for relocating, considering the original plant layout.

Usually there is no danger—unless a light-products pump springs a leak or something else lets go upwind of the boilers. Then the steam curtain goes into action. This home-engineered device is nothing more than a perforated 2-in. pipe supported an inch or so above-ground and surrounding the outdoor-type boilers adjacent to operating or storage areas. Divided into individually-controlled sectors, these lines connect to the high-pressure steam supply and are turned on and off manually. Water is injected to desuperheat the steam.

When operating, a curtain of wet steam rises in a "wall" about the boilers to about 15 ft. The steam is not so hot that it would endanger personnel walking through it. To date there has never been a major fire or vapor release sufficient to thoroughly test the steam curtain but plant personnel believe it will sufficiently dilute and divert any hydrocarbon vapors moving toward the boilers to prevent a fire near the boilers or a flashback to the source of the escaping vapors.

Table 3—Specifications for Gasoline, Petroleos Mexicanos

	Super Mexolina and Mexolina	Truck & Bus fuel (60 Oct.)
Dist., ASTM, °F:		
10%	122–158	158 max.
50%	203–248	266 max.
90%	320–338	311 max.
End Point	400 max.	400 max.
Residue, %	1 max.	2 max.
Loss, %	1 max.	2 max.
Sulfur, % Total	0.1 max.	0.25 max.
Mercaptan*	0.01	...
Doctor	...	negative
Corrosion, Cu strip	negative	negative
ASTM Gum, mg.	10 max.	10 max.
Induction Period, min.	200	180
Reid vapor Pressure, lbs.	9 max.	9 max.
Octane, Motor Method	80 min.**	60 min.
TEL, max., cc./gal.	3.0	3.0

* UOP Method H-163-40
** Mexolina (Regular) Tests 70 Octane Minimum

Table 4—Specifications for Light Fuel, Petroleos Mexicanos

	Kerosine (Petroleo Diafano)	Tractor Fuel (Tractomex)
Flash, T.B., °F.	106	106
Distillation, ASTM:		
IBP, °F.	302	302
% over at 392° F. max.	15	**40–50
% over at 455° F. max.	94	94
End point °F. max.	545	545
Doctor	negative	negative
Corrosion, Cu strip	negative	positive
Sulfur, % max.	0.4	0.5
Smoke points* mm. min.	25	...

* Institute of Petroleum "Standard Methods for Testing Petroleum and its Products," No. K-36 3rd Edition (1935)
** Within range shown.

Table 5—Specifications for Diesel and Heavy Fuel, Petroleos Mexicanos

	Diesel Fuel (Gasoleo)	Industrial Fuels			Heavy Fuel (Bunker "C")
		Grade 1	Grade 2	Grade 3	
Gravity, °API	35–39	...	...	...	...
Flash, PM, °F, min.	151	151	151	151	151
Visc., Saybolt sec.:					
Universal @ 100° F.	33–40	...	...	...	...
Furol @ 122° F.	...	70	80–100	160–200	250–300
Cloud Point, °F. max.	54	...	...	...	...
Carbon Residue, Conradson, %	0.04 max.	...	...	...	...
Ash, %	Trace	...	...	...	...
Sulfur, % max.	1.20	...	...	...	...
Diesel Index	60	...	...	...	...
Heating Value, cal./g., min.	...	...	...	...	10,200
Color, Union, max.	4	...	...	...	...
BS&W, %	Trace	2	2	2	2
Water by distillation	Trace	...	...	...	...

Product Specifications

The specifications for most refined products at Atzcapotzalco follow the analogous requirements in the U. S., since most of the motorized equipment of Mexico is imported from the U. S. Product standards are the same for all Mexican refineries.

Tables 3 through 5 show the specifications for representative principal products at Mexican refineries. The principal omission is aviation gasoline, made only at Atzcapotzalco and conforming to U. S. specifications. Alkylate concentration in Mexican avgas is higher than in the U. S., due to lack of aromatics in the base stock. Grade 100-130 generally tests 115-130 because of the large amount of alkylate included.

Table 6 shows wholesale refinery prices, FOB Atzcapotzalco. These include taxes, all of which are collected as soon as the product is loaded for shipment or inducted into a pipeline (such as certain fuels for use in Mexico City). For convenience these prices also have been converted into the U. S. equivalent at the free exchange rate of 8.65 pesos (Mexican dollar) per $1 U. S.

Product Quality Control

For some time the refinery at Atzcapotzalco had difficulty in selling its aviation gasoline to foreign airlines operating in Mexico, but time has demonstrated that product quality could be maintained. Today both foreign and domestic airlines use all the avgas produced at Atzcapotzalco. At its own expense, Pemex retains an impartial referee in the refinery, who tests every shipment of aviation gasoline, certifying the quality to the purchaser. The referee is a resident agent of the Charles Martin Co. In Tampico this organization also performs referee tests on all products being exported and crude oil. The E. W. Saybolt company of the U. S. also performs a similar function at Tampico.

For its internal protection, Pemex maintains a quality control organization entirely separate from any

other operation. Although relatively new, the results at Tampico have been so satisfactory that it now is planned to add the two as yet "unmonitored" refineries at Atzcapotzalco and Salamanca and eventually include all domestic product movements.

Called the Inspection & Shipping Department, its main office is within the grounds of the Madero refinery at Tampico. From here it controls shipments of all crude and products being exported through Tampico from the so-called "North Zone". Domestic cargoes, tank cars or barges destined for other zones from the three Tampico plants are not refereed. Another office of this department is maintained at Minatitlan in the so-called "South Zone," whose port is Puerto Mexico (Coatzacoalcos). A branch at Reynosa, across the Rio Grande from McAllen, Texas, performs a similar function at the refinery there.

The principal purpose of this organization, even though quality tests finally may be certified by one of the two official referee agents, is to "catch" any "off-specs" materials before they are checked by the referees.

In the interests of product uniformity and standardization, Pemex is to be congratulated on the establishment of this independent testing organization. The intention is to expand its functions and responsibilities and ultimately to test all refinery products regardless of destination. Its records of tests would prove of great value in the event of litigation or political changes involving product quality.

Laboratories

The most complete laboratory facilities of the Pemex refineries are at Atzcapotzalco, partly because the refinery operations there are the most complicated but also due to the fact that personnel and facilities are handy to main office operating departments which carry on special investigative projects from time to time. Basic research facilities are not maintained since industrial conditions in Mexico have not encouraged such ventures in the past.

Quite modern equipment is provided for both "control" and chemical laboratory work. Non-college technologists do most of the control work under supervision of the more technically-trained personnel. Most of them are on-the-job trainees. Several women chemists handle much of the gas and chemical analysis, using low-temperature distillation as well as the infra-red spectrograph. The laboratory produces its own liquid air for gas analysis. No mass spectrograph equipment is installed. A special chemical engineering department is not maintained but male and female chemical engineers are on the laboratory staff.

Table 6—Wholesale Prices of Petroleum Products, FOB Distrito Federal

Product	Price including taxes	
	Pesos/gal.	U. S. $/gal.*
Avgas, Grade 100-130	2.19	0.253
Avgas, 90 oct.	2.095	0.242
Avgas, 80 oct.	1.785	0.206
Super Mexolina (Premium 80 oct. M)	1.714	0.198
Mexolina (Regular, 70 oct. Motor method)	1.380	0.16
60 oct. gasoline (for city buses only)	1.238	0.143
Kerosina (stove oil)	0.527	0.061
Tractomex (kero. dist. for tractors)	0.476	0.055
Gasoleo (Diesel fuel), 60 D.I.	0.476	0.055
Combustoleo ("Light" Fuel Oil Meets U. S. Spec. for Grade F.S. No. 6) per gal.**	0.238	0.028
"Heavy" Fuel per bbl.	9.00	1.040

* Conversion: 8.65 pesos per U. S. $1.

** There are three different industrial grades of fuel oil marketed by Pemex differing only in Furol viscosity at 122° F., as shown in Table 5.

The usual complement of CFR test engines, are provided, but operated only to give octane ratings by the Motor Method. Motor fuels produced with present refining methods have only a minor sensitivity and hence the Research Method has not yet been considered worthwhile under the circumstances. Electronic knockmeters are used on the test engines. Two engines for testing Diesel fuel are installed.

In the laboratories the sound proofing of walls and ceiling has eliminated the necessity of partitioning off the engine room from the rest of the control laboratories. The sound proofing material is a mixture of fibrous asbestos with a minimum of cement, applied as a surface coating to ceiling and to the walls beginning about six feet above the cement floor. Very roughly-textured and applied by hand methods, it effectively absorbs the clatter which would give an objectionably high noise level in a room with smooth hard walls and floor.

The same arrangement has been tried with good results in other laboratories where the noise level is not as high and several offices have been thus "soundproofed". In these cases the entire ceiling and the top foot or so of the walls are coated with the mixture and the balance of the wall area finished as desired. The natural whitish-gray color of the mixture aids light diffusion.

In the laboratories, the research work carried on in general is slanted toward plant problems, rather than fundamental type of investigations. Each year a technical meeting is scheduled, attended by representatives from the chemical departments of the various refineries, among others represented. Each laboratory is expected to report on at least one piece of original research.

One of the recent reports from Atzcapotzalco dealt with the various hydrocarbons normally present in the refinery gasoline streams, which might be segregated under proper conditions for use in improving aviation gasoline quality or increasing production. This work proved itself in actual application by a slight improvement in product quality and a definite monetary saving through increasing production.

The future holds a number of changes for the Atzcapotzalco refinery, the first on the list being an increase in throughput capacity for the McKee unit to 40,000 b/d through installation of larger pumps, condensers and heat exchangers.

New heaters for the other two topping units already have been mentioned, and likewise the capacity increase for the crude pipe line serving the refinery. Another 125,000 lb./hr. boiler (there are three now) will be built within the next year. For the moment it will not be necessary to increase installed electric generating capacity, since one of the two existing 5000-kw turbogenerators is a standby and could be put on-stream at times of heavy load. An increase in cooling tower capacity also will be required.

In general, it is now the plan to install utilities before or simultaneously with construction of new processing units. It is believed these latter can be anticipated sufficiently in advance so that, long before new units are ready to operate, all required utilities will be ready.

Next on the list is a nearly 60% increase over existing rated crude throughput to the neighborhood of 80,000 b/d (probably in 1955). This will be accomplished by installing essentially a duplicate of the existing McKee unit.

Among future plans also is the installation of an Edeleanu sulfur dioxide extraction unit to treat middle distillates for sulfur removal. This will improve Diesel oil stocks, and sulfur reduction in stove distillate and tractor fuel will help minimize corrosion in the consumers' equipment.

Although somewhat speculative at this point, it is not unlikely that some form of catalytic cracking will be installed at Atzcapotzalco perhaps by 1954-56.

(Continued next month)

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(1) R. O. Mena, S. A. Guerreri and D. W. Wilson, "Product Flexibility, Low Fuel Consumption Feature Modernized Pemex Refinery," PETROLEUM PROCESSING, May, 1947, pp. 334-48.

(2) Thornton, D. P., Jr., "HF Alkylation today," PETROLEUM PROCESSING, May, 1951, p. 491.

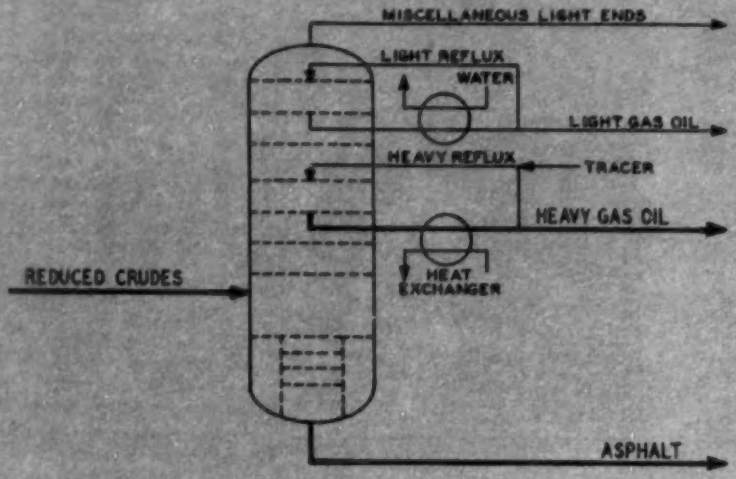

FIG. 1—Simplified flow diagram of the vacuum distillation unit in which radioactive tracer technique was used

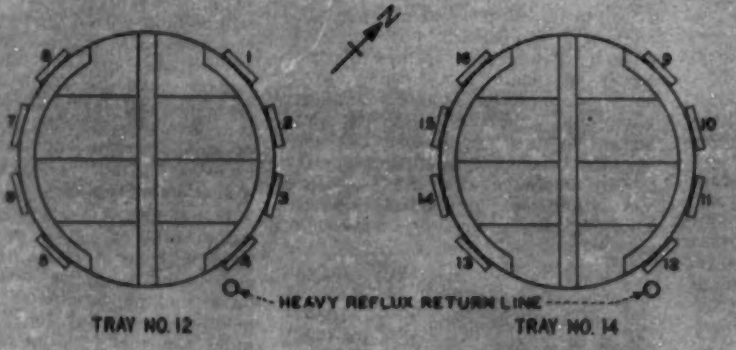

FIG. 2—Numbered stations for the Geiger counter tubes on the vacuum still

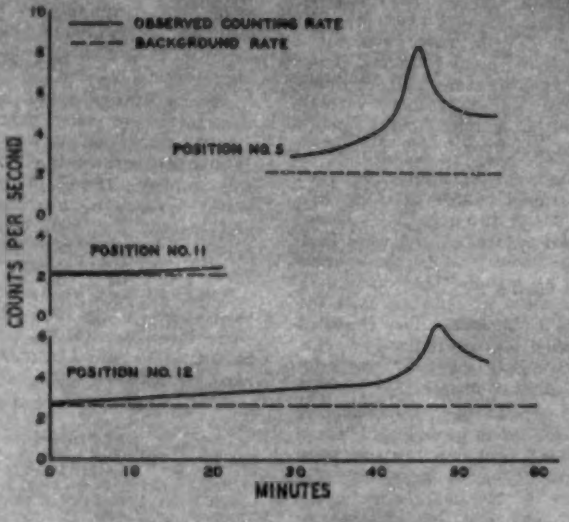

FIG. 3 — Results of the preliminary tracer test

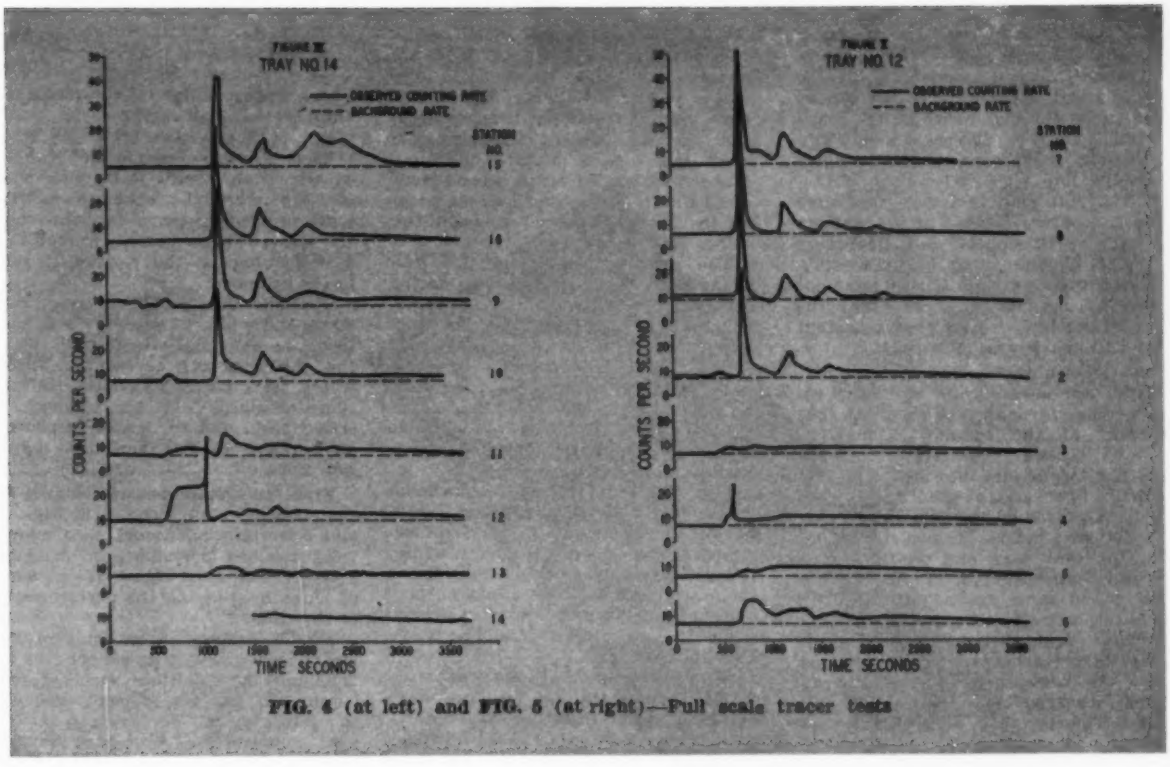

FIG. 4 (at left) and FIG. 5 (at right)—Full scale tracer tests

Using Radioactivity in the Refinery

How tracers permit flow studies in vacuum still

By G. C. GESTER, Jr., R. D. LEE, and D. E. HULL
California Research Corp.

RADIOACTIVE tracer techniques are being employed in an increasing number of applications in the petroleum industry.

The movements of oil and of water through oil-bearing formations have been studied, using radioactive isotopes of iodine.[2][6] A commercial process has been developed for use in acidizing treatment of wells, to confine the radioiodine-labeled acid to the level of the formation being treated.[1] The efficiency of distillation columns is studied with one of the components labeled with radiocarbon.[5] Various products shipped consecutively in a pipe line are distinguished by an interface tracer containing radioantimony.[3][4] Wear of engine parts as affected by fuels and lubricants is studied with parts that have been radioactivated by neutron irradiation in the nuclear pile.[7]

This paper describes the use of tracer techniques to study the flow characteristics across the trays of a large vacuum distillation column. Fig. 1 is a simplified flow diagram of such a unit. This technique provides a major simplification over previous test methods, which involved elaborate facilities for internally sampling liquid from various sections of trays or inspection of water flow over the trays.

The bubble cap trays in the column studied are designed for half cross flow with liquid flowing toward center downcomers on odd numbered trays and toward peripheral downcomers on even numbered trays. Liquid flow on each tray is divided into eight compartments as shown in Fig. 2.

A preliminary test of the feasibility was made first. The only suitable tracer available at the time was cobalt-60 in the form of cobalt naphthenate. Seven-tenths of a millicurie of this was dissolved in one liter of gas oil. This solution was injected into the column on the tray immediately below the heavy gas oil drawoff by atmospheric pressure.

Geiger counters were attached at Stations No. 11 and No. 12 on Tray No. 14 (4 trays below the injection point). The location of these points in indicated in Fig. 2. About half the tracer material was injected continuously over a half-hour period to determine the effect of continuous injection.

The counting level at Station No. 12 rose to about 1 count per second above background during this interval, but no response was measurable at Station No. 11. The counter at Station No. 11 was then moved up to Station No. 5 on Tray No. 12 (2 trays below the injection point).

After about 40 minutes the remaining tracer material was injected in one slug. The counter on Tray No. 12 rose to a peak of 4 times background 7 minutes later, and the counter on Tray No. 14 indicated twice background 9 minutes after the final injection. In Fig. 3 the variation of counting rate with time at each station is shown.

These data demonstrated the feasibility of the second method. For a full-scale test with injection into the heavy reflux, more tracer would be required because for each unit of fluid passing down the column over Trays 12 and 14, 2½ units passes out the heavy gas oil drawoff line. A shorter-lived tracer material was selected to avoid the use of 5-year cobalt-60 in the larger quantities required.

Arrangements were made with the

Atomic Energy Commission office at Oak Ridge, Tennessee, to use 60-day antimony in the form of triphenylstibine for the full-scale test. This material is the same as that used as a pipe line tracer.(4)

The full-scale test was conducted with counters located at all stations on Trays 12 and 14, as indicated on Fig. 2. Column operation was established in such a way that entrainment was taking place, as judged by the color and high heavy metals content of the heavy gas oil stream.

As shown on Fig. 1, the tracer material was injected into the heavy reflux line which injects fluid into the center of the column. Liquid on Trays 12 and 14 is received at the center and divides into eight streams which flow across the tray to the circumference of the column and fall to the tray below. Because of baffles in the seal pans and on the trays, liquid distribution on Trays 13 and 15 is the same as on Trays 12 and 14, respectively.

Thus, liquid distribution on four of the six trays between the flash zone and the heavy gas oil drawoff tray was measured. Injections containing 10 millicuries in a pint of kerosene were made with a "Sparklet" bottle pressured with a CO_2 cartridge. The tracer was introduced into the reflux return line sufficiently upstream of the column so that it was thoroughly mixed with the reflux before entering the column.

Fig. 4 shows the results of the test on Tray No. 14. The zero point on the time scales merely refers to the time at which all scalers were started simultaneously and does not indicate time of injection of the tracer. In the four sections of the Northwest side a sharp peak of 40 counts per second appeared as the tracer passed over Tray No. 14 less than 3 minutes after the injection. The activity fell off following the peak, but 7 to 8 minutes later, before it had leveled off, a second peak of 12 counts per second was observed as the tracer returned through the reflux circuit.

The second peak was much less pronounced than the first, primarily because it was mixed with a larger volume of hydrocarbon fluid and also because some of the tracer was diverted to the product line. A third peak appeared about 7 to 8 minutes later, but its intensity was only about 7 counts per second. The fourth peak was so weak as to merge into the background level.

The counting level at all stations was higher as a result of the tracer having been mixed in the reflux stream, but decreased toward the initial background level. In contrast to this pattern, the four sections of the opposite side of the column showed little or no increase in radioactivity above backround.

After an hour the counters were moved to new stations on Tray No. 12 and another injection was made. The results plotted on Fig. 5 were similar to those on tray No. 14.

It will be noted from the plan view (Fig. 2) that the heavy reflux line rises up the column adjacent to stations 4 and 12. The humps on Fig. 4 (and to a lesser extent on Fig. 5), starting at about 600 seconds (arbitrary scale of elapsed time) on curves for stations 9, 10, 11, and 12 are the result of our carrying the "hot" material, on ground level, past these stations and manipulating the injection equipment (700 to 1000 seconds on Fig. 4). The high peaks at stations 4 (600 seconds) and 12 (1000 seconds) represent flow of the tracer up the external line carrying the heavy reflux to its injection tray.

The primary conclusion to be drawn from these tests was that liquid flow in the column was not uniform over the trays. On both trays the liquid flowed mainly through the four sections on the Northwest side of the column.

The column subsequently was shut down and water was passed over the trays in amounts approaching fluid flow during normal operations. These water tests corroborated the indications obtained from the radioactive tracer tests and corrective measures were taken to distribute the liquid flow evenly over the trays.

From the characteristic shapes of the counting curves shown in Figs. 4 and 5 certain additional conclusions were reached pertaining to hold-up volumes and flow rates which were of value in studying the performance of the column:

(1) The volume of the liquid in the reflux piping and heat exchangers is indicated by the time required for passage of the tracer peak through the reflux cycle. The average measured between the first and second peaks as observed at Stations 1, 2, 7, 8, 9, 10, 15, and 16, was 449 ± 9 seconds. From known physical dimensions it was possible to check the reflux flow meter to within 10% of its indicated readings. This meter cannot be calibrated readily from tank gages. Precise reflux rate determination is essential for satisfactory heat and material balances which must be made to evaluate plant performance.

(2) The rate of attenuation of the well mixed activity in the reflux stream is an indication of the volume rate of withdrawal of liquid from the cycle. The average residence time of a tracer molecule in the system was observed to be 990 ± 90 seconds. From the liquid volume in the system (calculated from its dimensions), and the rate of withdrawal from the column (calculated as suggested in Item 1), one can estimate the total liquid flow passing down the column below the product tray. This rate was found to be in reasonable agreement with the liquid rate calculated by heat and material balances.

Meet the Authors

G. C. Gester, Jr., and R. D. Lee are senior research engineers in the refinery technology and technical service division of California Research Corp., Richmond, Calif. D. E. Hull is a senior research chemist for the company.

Mr. Gester received his technical training at the University of California and MIT and joined Standard Oil Co. of California in 1941. Since 1944 he has been performing technical service work in lube oil and crude distillation at Standard Oil Co.'s Richmond refinery. Active in the American Institute of Chemical Engineers, he was chairman of the Northern California section in 1950, and is general chairman for the national meeting to be held in San Francisco next September.

Mr. Lee did his undergraduate work at MIT and the Universities of Delaware and California. Following experience with du Pont and the Chemical Warfare Service, he came with Cal Research in 1945. He has been associated principally with crude oil distillation and thermal cracking technical service at Richmond.

Dr. Hull is an Ohio State graduate and received his Ph. D. from the University of California in 1935. From 1936 to 1942 he was on the chemistry faculty at the University of Minnesota. During the war years he was associated with the Manhattan project at Columbia and at Oak Ridge. In 1946-47, he was a professional trainee at the Training School for Nuclear Technology at Oak Ridge conducted by Monsanto Chemical Co. His work at Cal Research has been on radioactivity applications to industrial problems.

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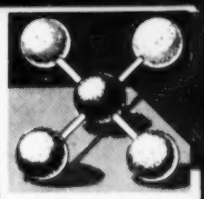

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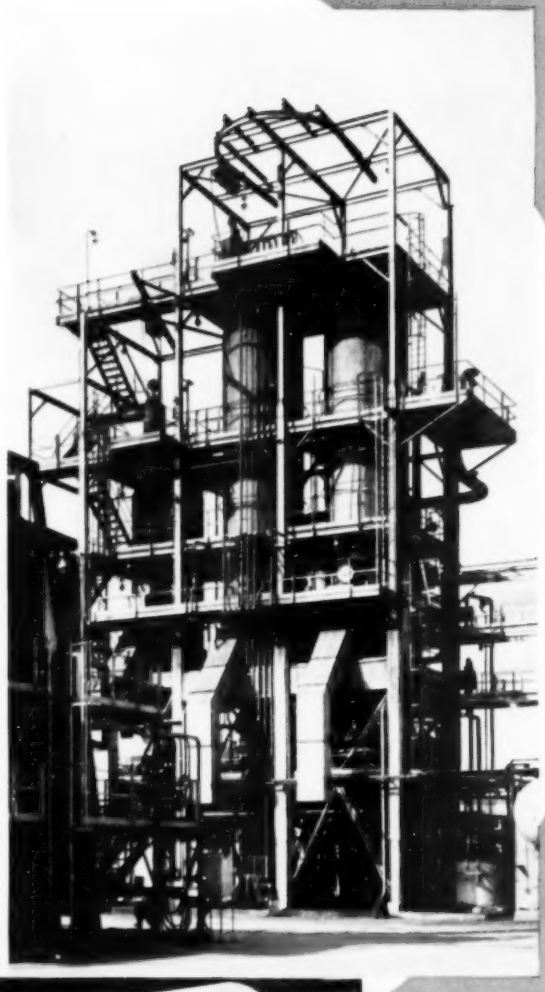

Right: Phosphoric acid plant at Scottish Oils, Limited, refinery showing the two reactors and the catch pot.

Below: The two phosphoric reactors and a catch pot ready to leave our Birmingham, Alabama plant for the Scottish Oils, Limited refinery at Grangemouth, Scotland.

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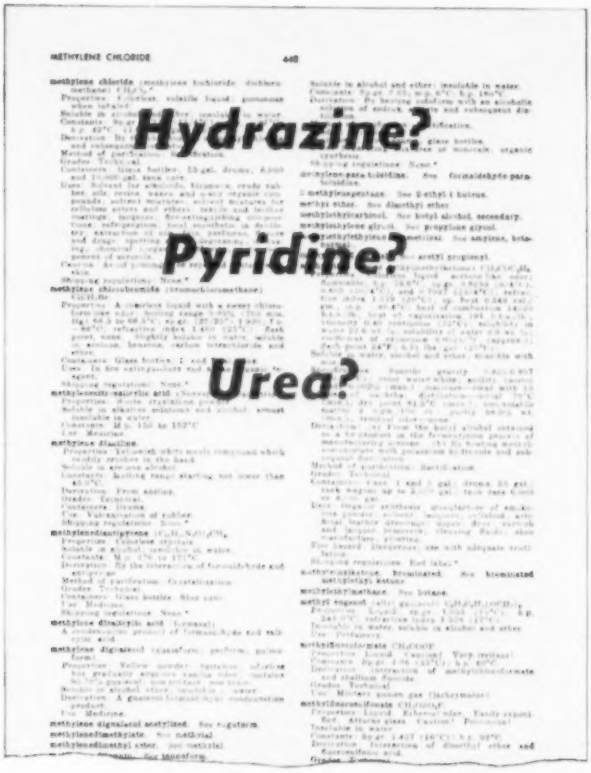

Background from "The Condensed Chemical Dictionary"
Courtesy of Reinhold Publishing Corp.

Do You Know These Words?

By B. H. WEIL
Head, Information Division
Ethyl Corp. Research and Engrg. Dept.
Detroit, Mich.

NEW arrivals among the petrochemicals are compounds familiar even to scientific personnel only through their early textbook chemistry. They now have fresh significance as materials derived from petroleum or natural gas, and with potential volume uses in chemical products. To introduce refinery men briefly to these substances—even how to pronounce their names—PETROLEUM PROCESSING is introducing this new feature—Editor.

Hydrazine

HYDRAZINE, pronounced "**high**-drah-zeen;" formula, H_2NNH_2. It is a colorless, fuming, corrosive liquid which weighs about the same as water and freezes and boils at temperatures not much different from it. It has usually been made by removing water from hydrazine hydrate, which in turn has been produced by oxidizing ammonia (NH_3) or urea (H_2NCONH_2). The vapor of hydrazine is explosive and highly toxic, being especially dangerous to the eyes.

Hydrazine has long been used to produce chemicals useful in many chemical reactions, such as in the manufacture of a catalyst for rayon production. It and its derivatives find application in many chemical tests. Like its basic raw material (ammonia), hydrazine is a powerful chemical reducing agent and solvent.

Hydrazine is of interest as a high-energy specialty fuel for rockets. The Armed Forces have studied it as a potential fuel for tanks, trucks, and rocket engines. "Space-travel" enthusiasts have proposed a hydrazine-nitric acid fuel combination as suitable to propel a man-made satellite to an orbit 1,000 miles above the earth. However, hydrazine costs far too much to be useful at present as a commercial fuel, even if its price drops to the figure of about 70c/lb. which has been estimated for production from large-scale plants.

Potential tonnage uses for hydrazine, if large plants are built to produce it, include: (1) an improved and less expensive soldering flux (hydrazine bromide); (2) an additive for glue which greatly increases its adhesive properties (produced by addition of a dibasic acid hydrazide and formaldehyde); and (3) a potent grass killer which does little harm to broad-leafed plants and would be useful for treatment of cotton fields before mechanical picking, etc. (maleic hydrazide). Other promising uses for chemicals made from hydrazine include insecticides, bactericides, pharmaceuticals, and foamed rubber "blowing" agents.

The raw materials for hydrazine—ammonia or urea—are both produced in large quantities

What Words Puzzle You?

In your reading of petrochemical literature you probably come across now and then a word which isn't clear to you. Perhaps it's a new product, like "hydrazine"—or a new process term, like "oxylation"—or something similar. Perhaps it's a word that has long been used in another field, but which is just coming into prominence in the petroleum processing industries.

Tell us about it and we'll try to include it in this new department. Write either the author, or the editor:

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from natural gas. Ammonia is made from nitrogen (from the air) and hydrogen, the latter being obtained by reacting natural gas with steam or air (the latter by partial combustion), then separating the hydrogen. Urea is being made in increasing quantities at natural-gas ammonia plants by reacting ammonia with carbon dioxide, which is available there in considerable quantities from the hydrogen-making step. It is quite likely that large-scale production of hydrazine, if and when it comes, will be based on natural gas.

Pyridine

PYRIDINE pronounced "**pier**-ih-dean;" formula, C_5H_5N. It has a cyclic structure similar to benzene in which one HC group has been replaced by a nitrogen atom. It is a colorless or slightly yellow liquid, of pungent odor and burning taste, which freezes well below the freezing point of water and boils at a slightly higher temperature. Until recently, pyridine has been obtained commercially almost exclusively as a by-product from the coking of coal.

Pyridine has long been used as a denaturant for ethyl alcohol, as a solvent in the rubber and paint industries, as a germicide, as a medicine, and as a raw material for synthesis of other chemicals.

In recent years, it has been in increasingly heavy demand for fabric waterproofing (Zelan treating), vitamin synthesis (niacin, niacinamide), preparation of medicinals (antihistamines, sulfa pyridines), and incorporation in synthetic fibers to improve dyeability. Demand has materially exceeded the supply, however, so that several petrochemical companies have recently begun producing pyridine and alkylated pyridines to close the gap between demand and maximum output from coal tar.

Pyridine and its usable substitutes, MEP, MVP, and VEP (2-methyl-5-ethyl pyridine, 2-methyl-5-vinyl pyridine, and 2-vinyl-5-ethyl pyridine, respectively), are being produced synthetically by the reaction of acetaldehyde (CH_3CHO) and ammonia (NH_3), or acetylene (C_2H_2) and ammonia. Acetaldehyde is currently being produced from ethyl alcohol (from petroleum ethylene), by oxidation of LPG or LRG, or from acetylene (produced from natural gas or petroleum). Ammonia is also being produced in large quantities from natural or refinery gases. Pyridine from coal tar will soon play only a minority role in the markets it has created.

Urea

UREA, pronounced "you-**ree**-aah;" formula, $CO(NH_2)_2$. It is a white, almost odorless crystalline powder, highly soluble in water and little more than half as heavy (per unit volume) as table salt. It melts at temperatures somewhat above the boiling point of water and decomposes before its own liquid reaches boiling. Urea has usually been produced by treating calcium cyanamid (made from coal, air, and limestone) with dilute acids, or by heating ammonia and carbon dioxide under presusre. Another name for urea is "carbamide."

Urea is famous in the history of chemistry as the first "organic" material to be made in the laboratory from "inorganic" chemicals (by the German chemist Wohler in 1828). It is the main product of the catabolism of protetin materials in the human body, about one avoirdupois ounce of it being excreted daily in the urine by the average person.

A chemical of many applications, urea has found its chief uses in the fields of plastics, adhesives, medicine, fertilizers, animal feds, wood seasoning, fire-resistant paints, and explosives (as a stabilizer). Most of these uses are expected to continue to increase, but chief attention at present is focused on the growing markets for urea as a nitrogen-bearing fertilizer for plants, as a raw material for adhesives, and as a protein supplement in animal feeds. It may also find use in petroleum refining and petrochemicals manufacture as an agent (via extractive crystallization) for the separation of types of hydrocarbons.

Much of the urea needed to meet these growing demands will come from natural gas. During 1952, for example, at least three of the new natural-gas ammonia plants on which construction was initiated planned to produce urea as one end product, to the extent of several hundred-thousand tons per year. In such plants, hydrogen is made from natural gas by reaction with steam or, via partial combustion, with air, then separated from the resulting mixture of gases. Ammonia is subsequently prepared by high-pressure reaction of hydrogen and nitrogen (separated from the air, usually by liquefaction). To make urea, the ammonia is then reacted under high pressure with carbon dioxide, available at these plants as an otherwise-unprofitable by-product from the hydrogen-making step.

Meet the Author

Ben Weil will be remembered by many readers as co-author of the pioneering series of articles on petrochemicals entitled "ABC of Chemical Derivatives from Petroleum", published in 1942-43 in the predecessor to PETROLEUM PROCESSING, the *Technical Section* of *National Petroleum News*.

A chemical engineering graduate of the Universities of Missouri and Wisconsin, he was head of the Information Section of Gulf Research & Development Co.'s Chemistry Division and of the Technical Information Service of the Georgia Tech Engineering Experiment Station, before taking his present position with Ethyl Corp.

He has contributed a number of articles to the petroleum and petrochemical literature, and last month was co-author of a paper on "The Literature of Raw Materials for Production of Chemicals from Petroleum and Natural Gas," presented at the American Chemical Society meeting in Los Angeles.

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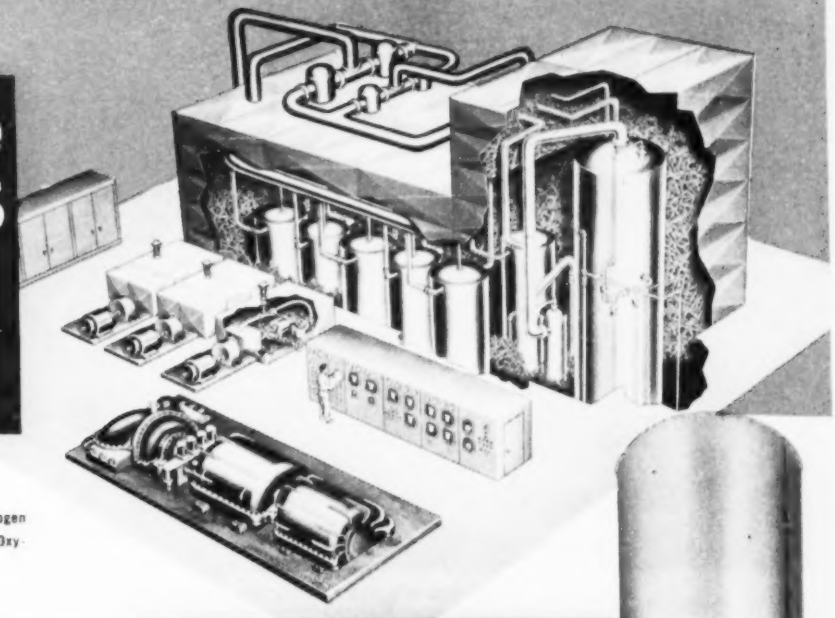

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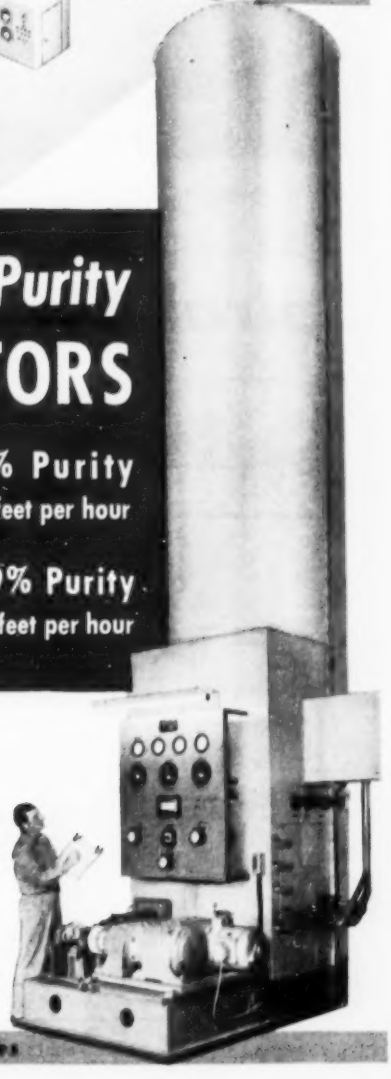

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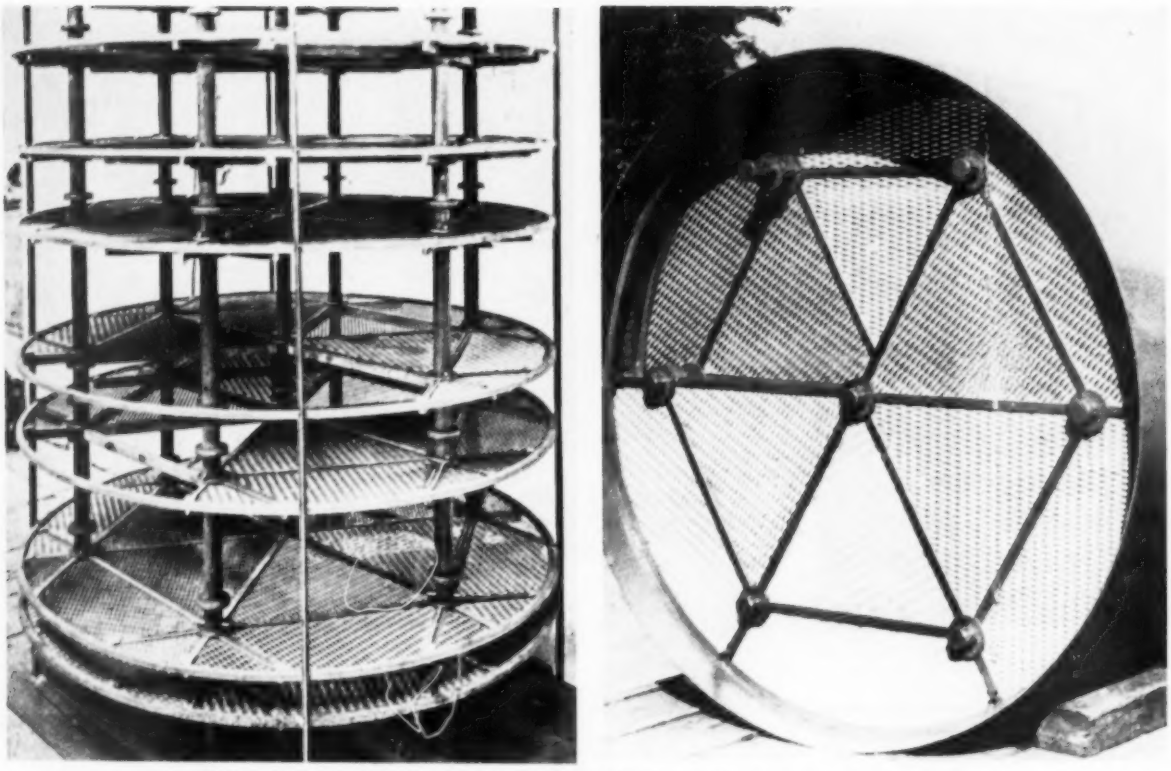

ANOTHER NEW FRACTIONATING TRAY DESIGN, shown in a model at the left and a commercial unit at the right, uses directional perforations to effect . . .

Spiral Flow for Better Distillation

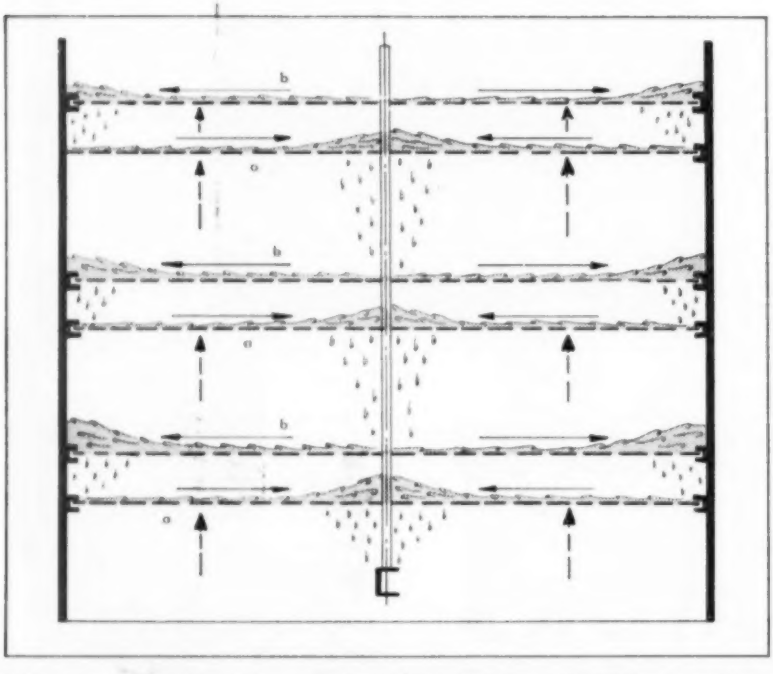

FIG. 1—Cross section of three contact plate structures, illustrating the principle of inward and outward flow of the liquid

IMPROVEMENTS in fractionating equipment, particularly tower internals, have long been the aim of many design chemical engineers. With the increased interest of petroleum processing technologists in petrochemical manufacture has come a corresponding increased attention to problems of higher fractionating efficiency and capacity, more precise separations, and lower construction and maintenance costs.

At least three new ideas for distillation trays have been announced during the past year—Shell's Turbogrid tray, which is composed essentially of a series of parallel bars and slots;[1] the perforated tray scheme of Celanese Corp. of America, developed for their petrochemical plants in Bishop, Texas, and Edmonton, Alerta;[2] and the Koch Engrg. Co.'s "Benturi" design.[3]

Now, a fourth, somewhat different approach has been introduced to the petroleum processing industries of the U. S. and Canada. It is the Kittel contact plate system, patented in both countries, which also uses perforated plates. However, the perforations are carefuly and uniformly calibrated, and the openings are inclined tangentially.

Resultant effect is to produce a

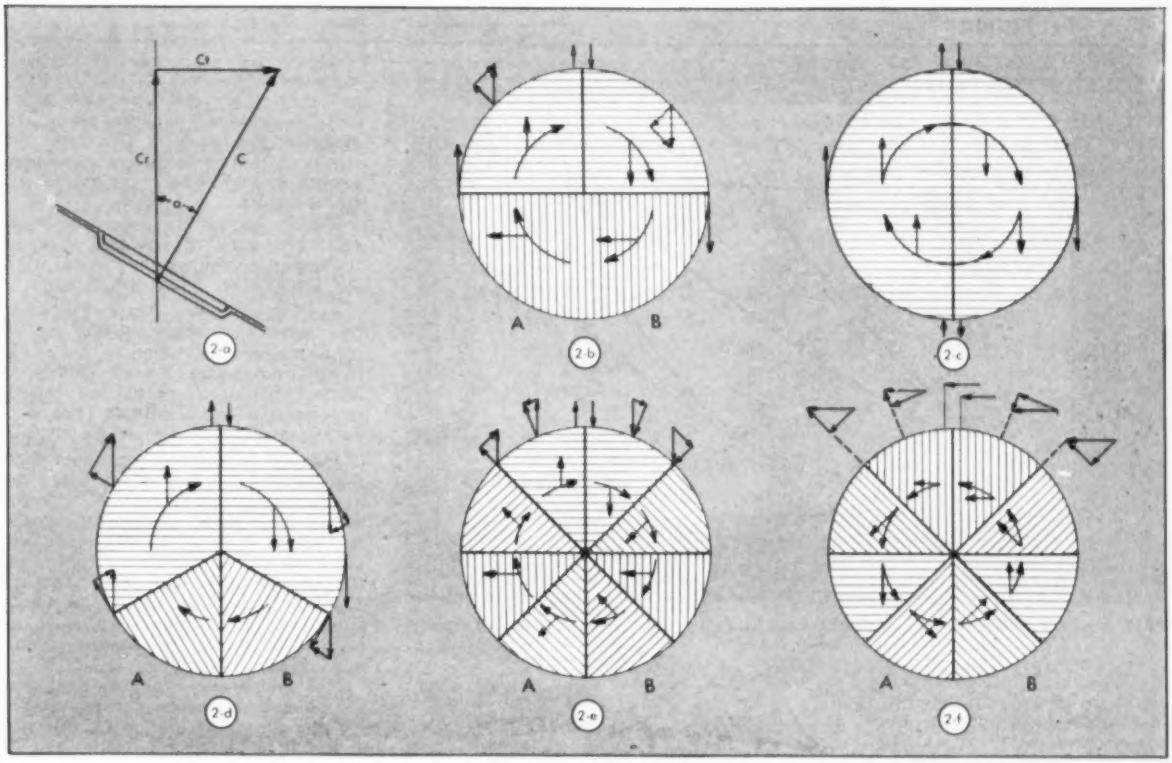

FIG. 2—Principles of flow on the contact plate and division of the plate into different zones

combination of centrifugal and centripetal movement of the counterflowing liquids and vapors, as illustrated in the drawing in Fig. 1. This eliminates all down-comers, utilizes all available capacity within a given tower, and reduces the quantity of liquid on a plate to a minimum.

The Kittel tray idea was developed by Walter Kittel, of Gmunden, Austria, in 1942, and has been in commercial use for some time in Europe on a variety of applications. It is now being introduced here by an American consulting engineer, acting as a representative in the U. S. and Canada.[4]

European applications include the following:

1—Distillation processes of all types (normal, pressure, and vacuum).

2—Gas scrubbing and stripping, such as the removal of CO_2 and C_2H_2 from coke oven, natural, and synthetic gases, with water under pressures up to 450 psi.

3—Direct cooling of air or gas with water; for example, direct cooling of compressed air in mining operations.

4—Degasification of liquids and treating of liquids for the removal of impurities.

5—Separation of heavy petroleum residues into special components (under vacuum).

Installations include those in the chemical works of Huels and Wesseling in Germany; Kuhlmann, in France; Montecatini, in Italy; B.A.-S.F., Oppau, Harpener Bergbau-A. G., Hoesch, Stinnes, and Linz, in Germany.

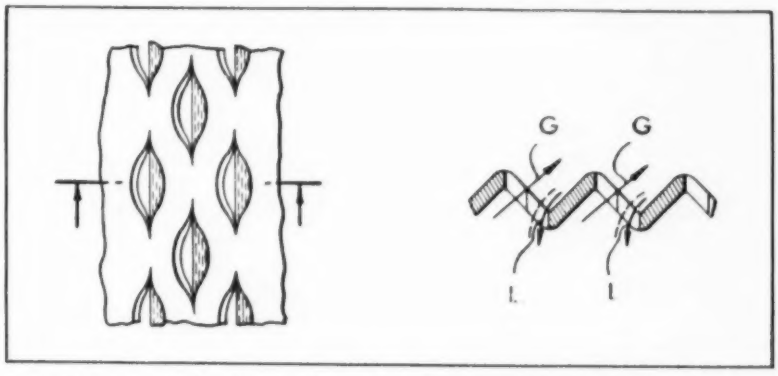

FIG. 3—Top and sectional views of expanded metal used in contact plate

The Kittel plate system is shown in the accompanying photographs of a model and of a commercial plate. It consists of at least two perforated plates or grids, one placed above the other at a variable but predetermined distance in accordance with required operating conditions.

The plates are made up of triangular zones or segments. By the arrangement of these segments in the plate, their inclined openings are so directed that—due to the kinetic effect of the ascending vapor—the liquid can be directed to the periphery of the contact plate or towards its center. The assembly of one plate with centrifugal movement of the liquid and a second plate with centripetal movement constitutes a "structure," which is the heart of the Kittel contact system.

In the normal arrangement of such a structure, the vapor outlet openings in the bottom plate are directed to the middle axis, and the flow in the upper plate is directed to the periphery. This procedure is repeated consecutively from one contact plate structure to the next. It is thus possible to achieve an alternating in-and-out flow of the liquid without special downcomers.

In spite of the high velocity of the vapor charge, the distance from structure to structure can be held

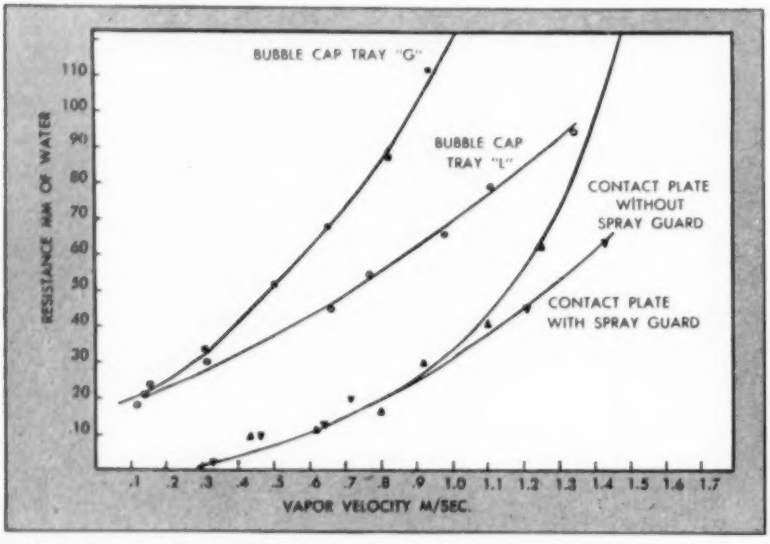

FIG. 4—Flow resistance of contact plates and two conventional forms of bubble cap trays

at 12 to 16 in., with the two plates themselves being 7.9 in. apart. The cross-sectional sketch in Fig. 1 of a set of three Kittel structures illustrates the alternate centrifugal and centripetal movement of liquid on the plates.

The contact plate structure is described as giving the same intimate contact as a packed ring column; but it is claimed to avoid any kind of canal formation or border movement of the liquid, such as occurs in packed ring columns. Other advantages claimed are: more intimate contact between vapor and liquid, providing higher efficiency in tower operation and greater tower capacity; and a very material reduction in the formation of deposits on the plates.

A construction advantage claimed for the Kittel system is that the plates are assembled of standard triangular segments. This permits greater convenience in installation in towers, with fewer manholes. The uniform, standard size triangles are manufactured of expanded metal. The special forming provides increased strength, it is stated, which makes possible the use of thinner metal. For most operations, a sheet with a maximum thickness of .2 mm. (0.079 in.) is sufficient.

The fundamental principle of the tray design, as translated from the foreign literature, is described as follows:

"The lighter medium—the gas or vapor which ascends through the column—as soon as it passes through the specially shaped openings of the contact plate, is subjected to a directional change from a vertical to a more horizontal flow position, in order to effect a like-directed movement of the liquid. This produces the desired circulation flow which may be directed and regulated in a radial sense.

"In this manner, a spiral vortex motion is produced upon the surface of the contact plate, of sufficient stability to make possible a considerable enlargement of the free-flow diameter up to 20% or more of the entire plate surface. The resulting lowering of the flow resistance achieves an important increase in throughput capacity.

"With such large openings and with the simultaneous employment of passage openings in the plates, it is possible for the liquid to flow down through the same rhombically-formed slots and therefore to eliminate the need for downcomers."

The contact plate is partitioned into two or more segments, so arranged with respect to the inclined perforations that optionally directed rotation flows of the liquid on the surface of the plate are produced. This partitioning of the plate into single segments also offers advantages in that the outlet openings can be arranged as desired for the most efficient operation.

The result is that rotation of the liquid is attained under the most stable flow conditions. On account of a corresponding radial regulation of the liquid through the arrangement of the plate in zones or segments, the centrifugal energy can be dealt with effectively. The stabilization of flow conditions eliminates the need for downcomers or downspouts for the liquid without the possibility of a rocking or pendulum action of the liquid upon the surface of the contact plate.

Fig. 2 shows schematically the division of the contact plate into different zones: At 2-a is a vector drawing showing in what manner the energies present are divisioned into radial and tangential components. The sketches 2-b through 2-f show the various forms of possible division and arrangement of the segments of the contact plate.

Fig. 3 shows the top plan view and corresponding sectional view of the expanded and formed metal used for the contact plate segments.

As can be seen from Fig. 2-a, by uniform rotation of the outlet openings for the vapor at an angle to the radius, the kinetic energy C of the horizontally outflowing vapors is separated into a radial (Cr) and a tangential (Ct) component.

Thereby, it can be determined that for the desired flow effect only, the uniformity of the directions Ct to Cr at all points on the contact plate is decisive in order to effect the impulse necessary for the rotation of the liquid layer, inasmuch as the vibratory impulse of the liquid layer subjected to rotation is sufficient to completely obtain the necessary stability.

This fact is important, as it allows for constructing contact plates of any desired diameter and with the required flow qualities, made up of individual segments if only they guarantee a more or less horizontal exit of the vapors in one direction.

If, for example, as shown in Figs. 2-b through 2-f, the contact plate is divided into two or more zones or segments with uniform openings, then certain specific energy fields result from the individual sections of the contact plate upon being charged by the vapor, the impulses of which, extending in the like rotary direction, increase in addition and which, as can be seen from the sketches, allow considerable variation, according to the number of the zones and their arrangement.

Within each energy field the vector diagram shows a remarkable change of magnitude of both components from the beginning to the end of the field (as seen within the flow direction) whereby the magnitude of one or the other components increases with increased division of the contact plate.

Furthermore, it can be seen from these diagrams, on account of the division into A and B, that the respective liquid charge upon the contact plate, either upon the periphery or in the middle, can be thoroughly accommodated for by suitable arrangements of the energy fields and that, furthermore, the directional motion of the liquid from plate to plate may be kept alike or changed.

The flow condition upon such a contact plate therefore—independent of the number of energy fields—is always characterized by the fact that the liquid performs simultaneously radial as well as circular motions, whereby a spiral flow from the peri-

phery to the middle of the contact plate, or vice versa, results in accordance with the direction given by the single energy field. Therefore, through special proportioning of the radial component, the possibility exists to counteract effectively undesired centrifugal forces which may occur upon very strong rotation of the liquid.

The particular portion of the kinetic energy still remaining with the vapor after leaving the liquid layer is transformed into pure rotation at the vapor space above this liquid layer, and in this manner renders possible a centrifugal separation of liquid drops which may have been carried over.

The complete stabilization of the flow picture in connection with a uniform division of the liquid upon the entire surface of the contact plate, according to the described arrangement, now can nearly completely replace the damming effect up to now a necessary condition with other trays or packings. This advantage allows a considerable reduction of the flow resistance of the plate by enlarging its opening ratio at a far greater degree than the present one.

In this manner, for instance, the single sections of a contact plate according to Figs. 2-b through 2-f, may be laid out in the desired arrangements, since each section has the uniform calibrated inclined openings. With such numerous, large openings, besides the lowering of the flow resistance, the possibility exists to allow the liquid, the movement of which upon the plate surface is dynamically conditioned, to flow off through the openings at the middle of the bottom plate and at the periphery of the top plate, without hindering by the vapor, even under extremely large charges, and without special downspouts. In this connection the use of the specially expanded metal, the passage openings of which are rhombically formed, favors the free down-flow of the liquid against the vapor.

Under certain specific conditions, the efficiency of the contact plates can be improved, it is claimed, if so-called spray-guard plates are installed above the top contact plates. These operate according to the same principle as the contact plates, except that they have larger slot openings for the purpose of preventing a damming up of the liquid. For increasing the separating effect, the direction of the passage slots in the spray-guard plates is reversed from that of the top contact plate.

The flow resistance and interchange efficiency of the contact plate system, with and without spray guards, in comparison with two conventional types of bubble cap trays, was studied in a test column of 59-in. diameter, employing a benzol-toluol mixture as test liquid. The tray spacing in general was 16 in., except in the case of the Kittel contact plates it was 7.9 in.

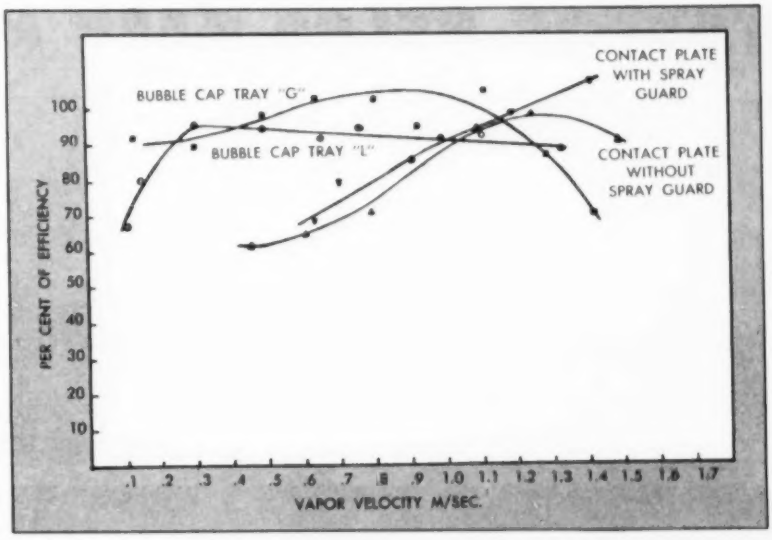

FIG. 5—Interchange efficiency of the contact plate and bubble cap trays

The considerable reduction of flow resistance as related to the enlarging of the opening ratio is shown in Fig. 4. The bubble cap tray type "G" (opening ratio approximately 8%) shows the greatest resistance value. With the type "L" tray, the bubble caps of which have on their borders larger gas outlet openings (opening ratio approximately 13%), the flow resistance is already lowered. The resistance characteristic of the Kittel system (opening ratio up to 20% or more) is lowered even more, and particularly with the spray-guards.

Also as shown in Fig. 4, the flow resistance of the contact plate system with decreasing load is quickly lowered and finally disappears, inasmuch as no further amount of liquid is present upon the surface of the contact plate.

Fig. 5 represents the respective interchange efficiency of the contact plate and the bubble cap trays. The ratio of the practically-obtained separation efficiency in comparison to the theoretical separation is given as a comparative value of the two types of bubble cap towers and contact plates.

The bubble cap trays, on account of the liquid layer always being present, show a very good separation efficiency with relatively low loads. The same corresponding value with the contact plate at first is somewhat lower, but improves with increasing load, inasmuch as the dynamic effects—rotation of the liquid and formation of a liquid layer upon the surface of the plate—depend on the kinetic energy of the vapors. The separation efficiency of 90%, for example, which is already attained by the bubble cap trays near the start, i.e., with a vapor velocity of 0.2 m./sec. (.66 ft./sec.) is reached by the contact plate with a vapor velocity of approximately 1.0 m./sec. (3.3 ft./sec.)

This apparent disadvantage is largely annulled if in this respect the corresponding flow resistances are considered. From Fig. 5 it can be seen that the contact plate system at a vapor velocity of 1.0 m./sec. (3.3 ft./sec.), has a pressure drop of only 30 mm. of water (2.2 mm. of Hg), a resistance degree which is obtained with both bubble cap trays already at a vapor velocity of approximately 0.3 m./sec. (1 ft./sec.). At a vapor velocity of 1.0 m./sec. the resistance of bubble cap tray "L" amounts to 70 mm. of water (5.2 mm. of Hg) and that of bubble cap tray "G" to 120 mm. of water (8.8 mm. of Hg).

This means that with regard to the dynamically conditioned characteristics of the Kittel contact plate system, adjustments can always be made wih respect to this condition. Both diagrams show that, in each instance, especially with the use of a spray-guard, sufficient margin is present to take care of sudden fluctuations of the charge during the operation.

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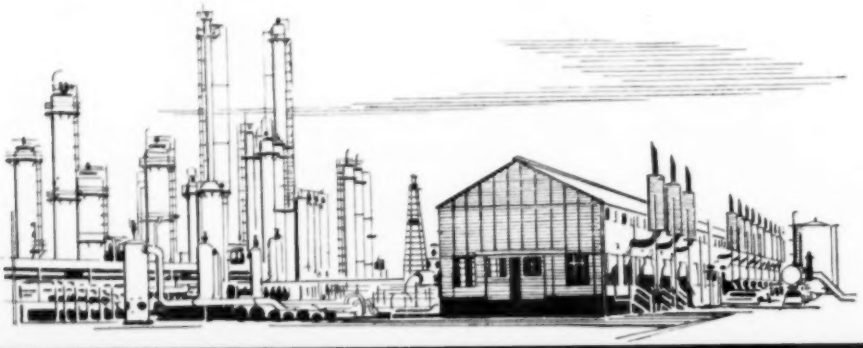
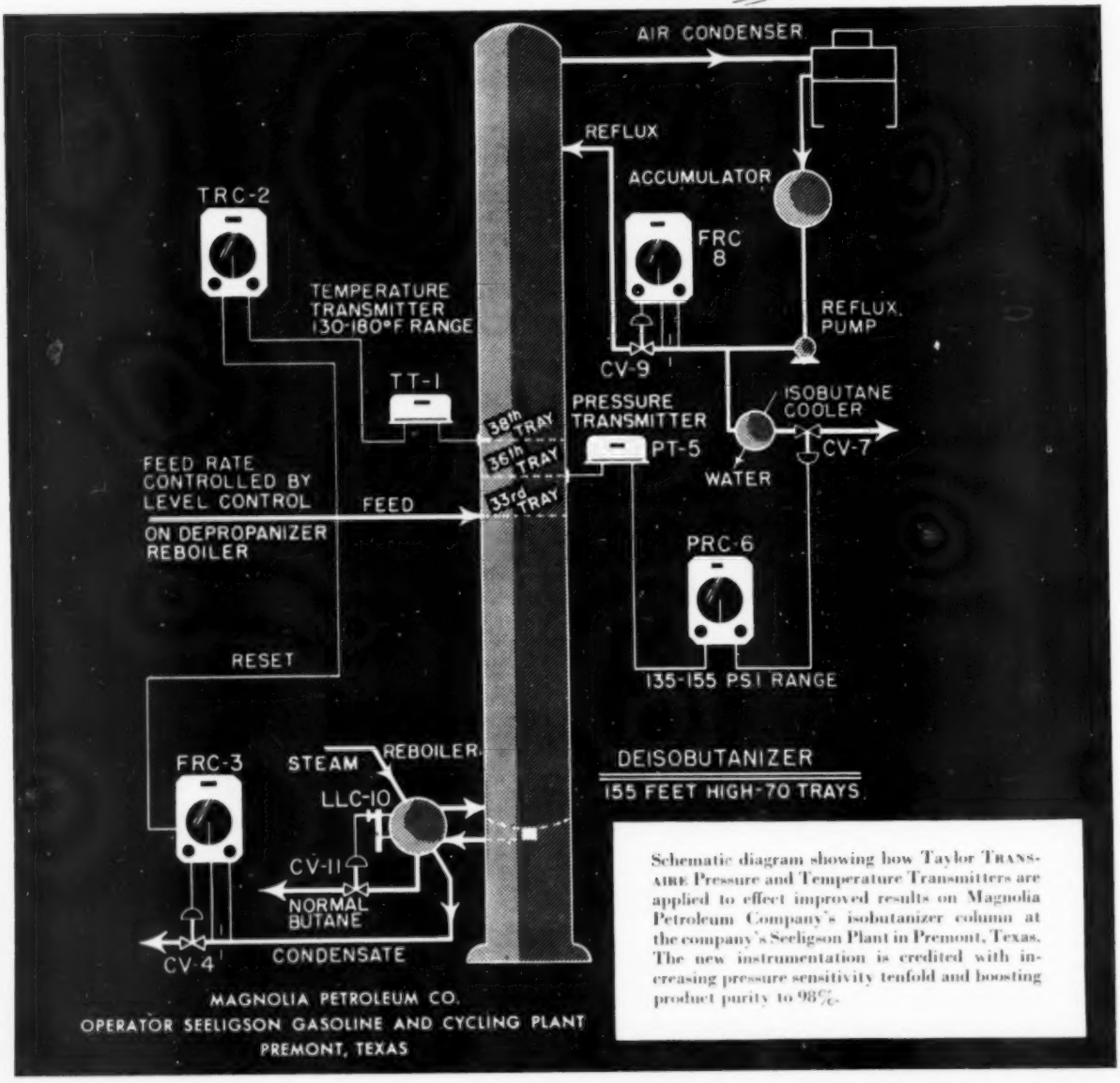


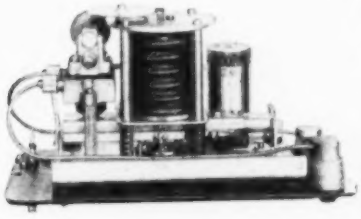


Schematic diagram showing how Taylor TRANSAIRE Pressure and Temperature Transmitters are applied to effect improved results on Magnolia Petroleum Company's isobutanizer column at the company's Seeligson Plant in Premont, Texas. The new instrumentation is credited with increasing pressure sensitivity tenfold and boosting product purity to 98%.

(To obtain more data on advertised products see page 600)

ISOBUTANE 98%+ PURE

THE Seeligson Plant, at Premont, Texas, a part-interest project operated by Magnolia Petroleum Company, has raised its isobutane purity from approximately 95% to consistently better than 98%. Manual adjustment of control instruments is a thing of the past. And purity tests are now made once during each 8 hour shift instead of at 2 hour intervals.

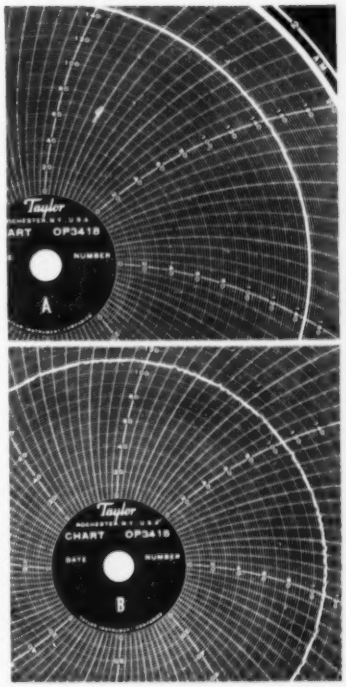


These very real benefits are traceable to the installation of Taylor TRANSAIRE* suppressed range temperature and pressure transmitters as measuring elements on the deisobutanizer column. Illustrated at left is present Seeligson Plant deisobutanizer instrumentation.

The temperature controller (TRC-2) used to be actuated by a conventional thermal system with a 0° to 200°F. range. Now the TRANSAIRE Temperature Transmitter (TT-1), with SPEED-ACT* (rate response in the measuring system) actuates this controller, operating with a range of 130° to 180°F. Thus sensitivity of temperature measurement has been increased two ways. Where a 200°F. change previously gave full scale deflection of the pen now a 50°F. change does the same thing. Well lag is fully compensated by SPEED-ACT rate action response in the measuring circuit.

The pressure controller (PRC-6) originally had a range of 0 to 200 psig. Now with the suppressed range TRANSAIRE Pressure Transmitter (PT-5) the range span is 20 psi, for 135 to 155 psig. With the conventional pressure system 1% of the controller chart range represented 2 psi pressure change. Now 1% of the chart represents 0.2 psi change, resulting in a tenfold increase in sensitivity of pressure measurement, as shown by charts at right.

Magnolia's use of Taylor TRANSAIRE transmitters is an excellent example of how these highly sensitive and accurate instruments permit better process control, effect operating economies and insure a consistently high quality product.



Comparative charts reflect the greater sensitivity of the new measuring system after Magnolia installed a TRANSAIRE Pressure Transmitter. Illustration A is a portion of an old chart when the measuring element had a 200 psi range span. Illustration B is a portion of a recent chart whose measuring element, a Taylor TRANSAIRE Transmitter, has a range span of only 20 psi. Each scale unit of the first chart equals 1.0 psi pressure change, each unit of the second only 0.1 psi.

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Thermodynamic Properties of Ammonia At High Temperatures and Pressures

Enthalpy and specific heat relationships for ammonia are presented over temperature range from −100 to 700° F. and a pressure range from 0 to 16,000 psia. They have been derived by graphical methods employing rigorous thermodynamic functions and using reliable experimental data.

While the properties developed in this article were originally planned to fill a specific demand involving the manufacture of urea, they are general in nature and can be used for any process design calculations.

This article is a summary of a thesis written by the author and submitted as a partial requirement for the degree of Professional Engineer to Clarkson College of Technology, Potsdam, N.Y. in June 1952.

By EDWARD R. GRAHL

Process Design Engineer, Foster Wheeler Corp.

RENEWED interest in the various processes for the synthesis of urea has been noted in many places.[1,5,14] This is not surprising in view of the important commercial outlets for the product, including its use as a fertilizer, as a raw material in the manufacture of urea formaldehyde resins, as a component in pharmaceuticals and, recently, as a cattle feed supplement.

The design of a high pressure synthetic urea plant cannot be undertaken without a knowledge of the high-temperature high-pressure properties of the basic raw materials—ammonia and carbon dioxide. While adequate thermodynamic data are available for carbon dioxide,[8,13] the only data for ammonia are those published primarily for the refrigeration industry[9,10] and, accordingly, they do not extend beyond the critical point.

Work reported in the previous literature[9,10] covered a temperature range of from −107.86° F. to 400° F., and a pressure range of from 0.88 psia. to 300 psia.

In view of the lack of high-temperature high-pressure data for ammonia, it was decided to undertake the development of the necessary thermodynamic properties. This work covers a temperature range of −100.00 to 700° F., and a pressure range of 0 to 16,000 psia.

Sources of Data

Constants: The molecular weight of ammonia was taken as 17.030, the boiling point as −33.6° C. (−28.48° F.), the triple point as −77.70° C. (−107.86° F.) and the heat of fusion as 125.85 Btu/lb. The critical constants were used as follows:

T_c = 132.4° C. = 270.32° F.
P_c = 111.5 atm. abs. = 1,637.9 psia.
V_c = 0.0686 ft³/lb.
Z_c = 0.2448

The values of critical temperature and pressure were taken from recent reliable sources.[9,10] The value for the critical volume was obtained from the National Bureau of Standards data,[9], and Z_c, the critical compressibility factor, was calculated from the relation:

$$Z_c = \frac{P_c V_c}{R T_c}$$

Vapor Pressures: Vapor pressures as reported by Stull[12] were used in this work. A cross check of various portions of the data was made against values calculated from fundamental P-V-T data.

The specific volumes for various temperatures for saturated conditions for both liquid and vapor were taken from data reported by the National Bureau of Standards.[9]

Heat Capacities: Zero-pressure specific heats as reported by Souders et al[11] were used. These values were calculated from spectroscopic data by statistical methods and are of a high order of accuracy.

Compressibilities: Keyes[7] reported compressibilities in 1931 from 30° C. to 210° C. and specific volumes from 1.50 to 5.0 cc./gm. These data, of which the maximum experimental error is estimated by Keyes to be 0.25%, have been used here. The data were arranged

Meet the Author

Edward R. Grahl began his engineering career in 1945, when he graduated from Clarkson College of Technology with a Bachelor's Degree in Chemical Engineering. His first position was with the Celanese Corp. of America where he worked in a developmental pilot plant and later in the Engineering Research Department. In 1947 he accepted a position with the Foster Wheeler Corp. as a chemical engineer in the Process Development Division, where the primary responsibility involved design improvements for existing processes as well as the development of new chemical processes. This is the position which he presently holds. Although he has been on loan to the Industrial Division where he was engaged in the design of complete chemical plants. His particular technical interests include thermodynamics and kinetics, fractional distillation, reactor design and gasification processes.

The author has attended New York University evenings and received a Master's Degree in Industrial Management in 1949. He then began graduate studies at the Polytechnic Institue of Brooklyn and expects to receive his Master's Degree in Chemical Engineering as soon as his thesis requirement is satisfied. He has also received the degree of Professional Engineer from Clarkson College of Technology in June of 1952.

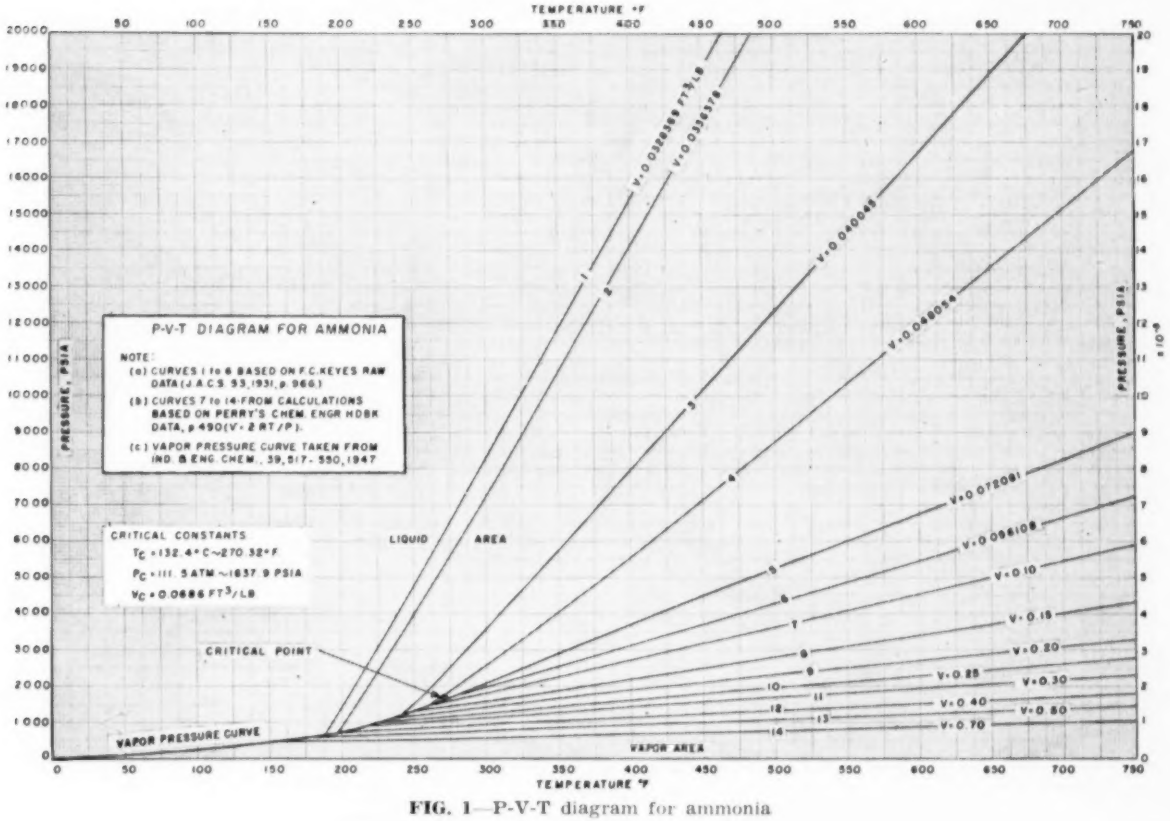
TEMPERATURE °F
PRESSURE, PSIA
P-V-T DIAGRAM FOR AMMONIA
NOTE:
(a) CURVES 1 to 6 BASED ON F.C.KEYES RAW DATA (J.A.C.S. 53,1931, p. 966)
(b) CURVES 7 to 14 FROM CALCULATIONS BASED ON PERRY'S CHEM. ENGR HDBK DATA, p 490 (V = 2 RT/P).
(c) VAPOR PRESSURE CURVE TAKEN FROM IND. & ENG. CHEM., 39, 517-550, 1947
CRITICAL CONSTANTS
T_C = 132.4° C = 270.32° F
P_C = 111.5 ATM = 1637.9 PSIA
V_C = 0.0686 FT³/LB
LIQUID AREA
CRITICAL POINT
VAPOR PRESSURE CURVE
VAPOR AREA
V = 0.0328358 FT³/LB
V = 0.0336578
V = 0.040045
V = 0.048056
V = 0.072081
V = 0.096108
V = 0.10
V = 0.15
V = 0.20
V = 0.25
V = 0.30
V = 0.40
V = 0.50
V = 0.70

FIG. 1—P-V-T diagram for ammonia

such that a complete P-V-T network was available with temperature as abscissa and pressure as ordinate with the specific volume as parameter as shown in Fig. 1.

Thermodynamic Development of Working Equations

Thermodynamic properties of ammonia were developed from reliable experimental data by the application of rigorous thermodynamic relationships. The details of the method employed have been discussed in the literature.[3, 4, 6] It is essentially one in which successive graphical differentiations and integrations are made involving cross-plotting and smoothing of the different functions.

In differential form the total change of enthalpy can be expressed as:

$$dH = \left(\frac{\delta H}{\delta T}\right)_p dT + \left(\frac{\delta H}{\delta p}\right)_T dp \qquad (1)$$

The first term on the right-hand side represents the change of enthalpy due to temperature change alone, the second term the change of enthalpy due to pressure change alone. We also know that:

$$\left(\frac{\delta H}{\delta T}\right)_p = C_p \qquad (2)$$

It therefore follows:

$$dH = C_p\, dT + \left(\frac{\delta H}{\delta p}\right)_T dp \qquad (3)$$

The first term on the right-hand side can be evaluated from zero-pressure specific heats, and the second term can be evaluated from a knowledge of the pressure-volume-temperature data. Both of these fundamental properties must be determined experimentally.

We also have the relationship:

$$\left(\frac{\delta H}{\delta p}\right)_T dp = V - \left(\frac{\delta V}{\delta T}\right)_p T \qquad (4)$$

Summarizing, we can write:

$$dH = C_p dT + V dp - T\left(\frac{\delta V}{\delta T}\right)_p dp \qquad (5)$$

Writing this in integral form we have:

$$\Delta H = H_o + \int_{T_o}^{T} C_p\, dT + \int_{p_o}^{p} \left[V - T\left(\frac{\delta V}{\delta T}\right)_p\right] dp \qquad (6)$$

where H_o is the integration constant. This would of course correspond to the value of enthalpy at absolute zero if the integration were carried out using C_p data valid to zero absolute temperature. The enthalpy base chosen in this work corresponds to 0 Btu/lb. at −100° F. saturated liquid. The second term of Equation 6 can be evaluated graphically from zero-pressure specific heats as mentioned above.

The third term on the right-hand of Equation 6 can be conveniently represented by the following development:

$$Z = \frac{pV}{RT} \qquad (7)$$

and

$$V = \frac{ZRT}{p} \qquad (8)$$

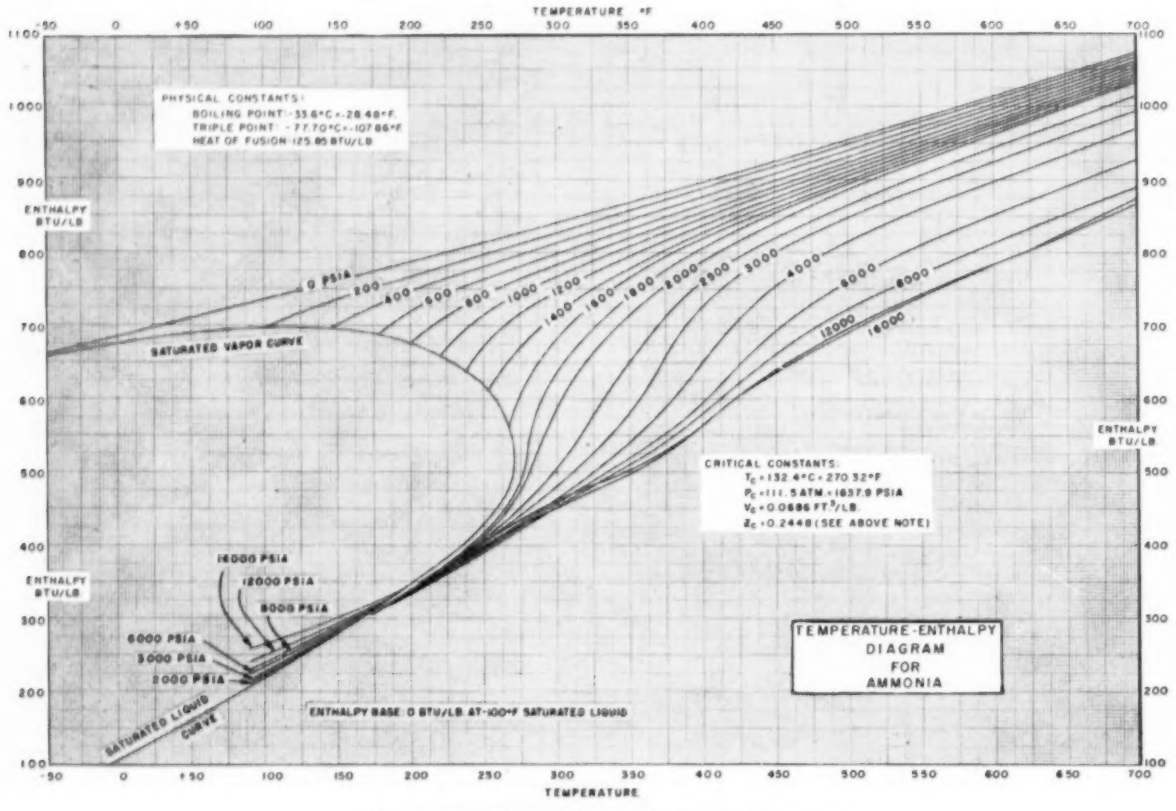

FIG. 2—Temperature-enthalpy diagram for ammonia

Differentiating Equation 8 and substituting it into the third term of Equation 6, canceling like terms and rearranging, we get:

$$\Delta H_f = -RT^2 \int_{p_o}^{p} \left(\frac{\delta Z}{\delta T} \right)_p \frac{dp}{p} \qquad (9)$$

Therefore, for graphical convenience, the total change of enthalpy can be expressed as:

$$\Delta H = H_o + \int_{T_o}^{T} C_p \, dT - RT^2 \int_{p_o}^{p} \left(\frac{\delta Z}{\delta T} \right)_p \frac{dp}{p} \qquad (10)$$

This is the specific form which has been graphically evaluated to give values of the enthalpy function.

The specific heat function is usually associated with the enthalpy function because, by virtue of definition, it bears the simple relationship shown by Equation 2. In this study the specific heat function was derived directly from a knowledge of the enthalpy function. Specific heat data can be used directly to obtain specific volumes; in fact, very accurate specific volumes can be obtained from only moderately accurate specific heats because one starts with second differentials and proceeds to integral values.

By a similar development from fundamental thermodynamic relationships, other functions can be derived which lend themselves readily to graphical methods. The entropy function, for example, could be expressed as follows:

$$\Delta S = S_o + \int_{T_o}^{T} \frac{C_p}{T} dT - RT \int_{p_o}^{p} \frac{1}{p} \left(\frac{\delta Z}{\delta T} \right)_p dp - R \int_{p_o}^{p} \left(\frac{\delta Z}{\delta p} \right)_T dp \qquad (11)$$

where ΔS equals the total change of entropy.

Application of Working Equations

The enthalpy of ammonia was evaluated in accord with Equation 10 developed above. The second term of this equation was calculated from reliable zero-pressure specific heats found in the literature.[11] Zero-pressure enthalpies were determined from zero-pressure specific heats by means of graphical integration, that is, by totalizing the area under the specific heat curve in accord with Equation 2.

The zero-pressure enthalpy line so determined then served as a reference line on the enthalpy-temperature chart from which a complete family of enthalpy isobars could be reckoned. The phase envelope was available from data in the literature.[9] As a first step in the evaluation of the change of enthalpy due to pressure as shown by Equation 9, the pressure-volume-temperature diagram, Fig. 1, was prepared from available data.[7] Vapor pressure and compressibility data were also available.[7, 12] Specific volumes of both liquid and vapor were required for calculating the compressibility factor for the critical locus, including Z_c.

With a complete knowledge of compressibility factors it was then possible to continue the evaluation of the enthalpy function. The steps in the procedure involve the following:

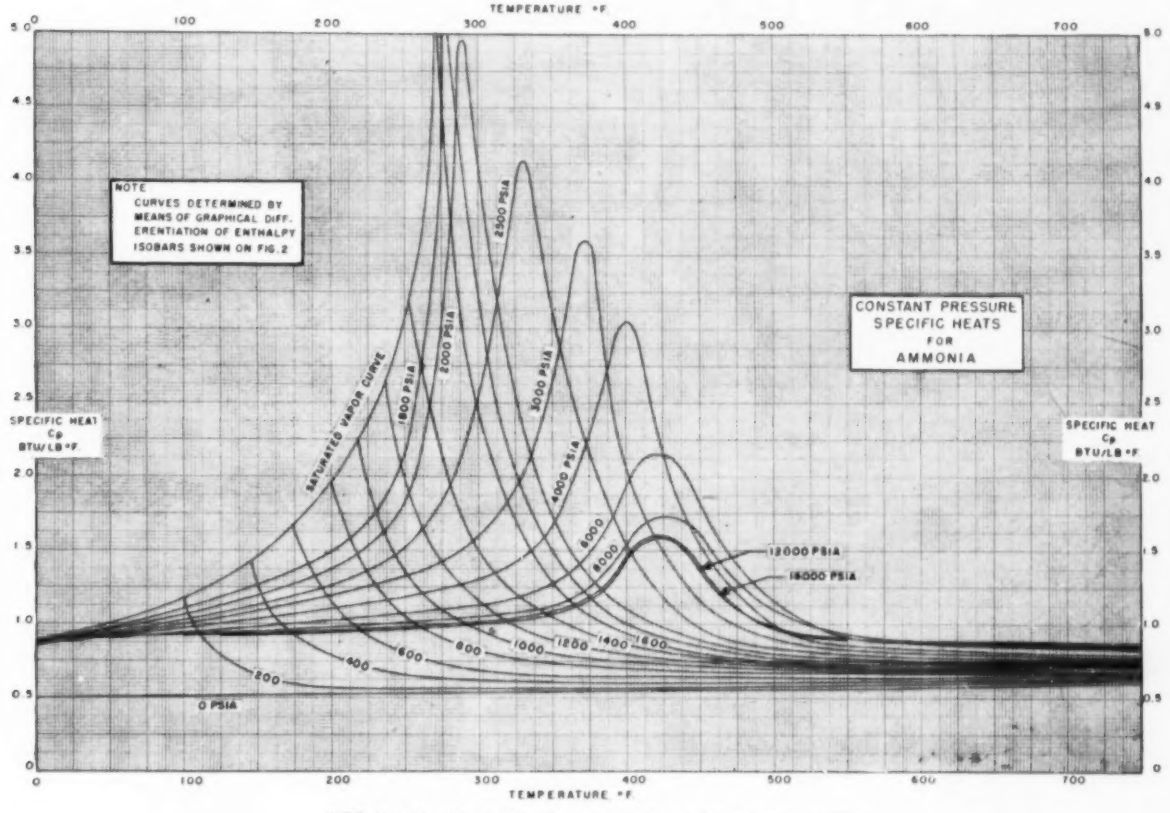

FIG 3—Specific heats for ammonia at constant pressure

(a) Graphical differentiation of the compressibility curves to obtain the function, $(\delta Z/\delta T)_p$,

(b) Plotting of this function against temperature,

(c) Cross-plotting the curves of (b) after multiplication by $(1/p)$,

(d) Determining the area under these curves in the usual manner giving the values of the integral desired, and

(e) Preparation of Fig. 2 from the data so obtained.

Smoothing of all curves was required and to enhance the accuracy of the work, large-sized graphs (some measuring 3 ft. by 5 ft.) were prepared.

The specific heat function was then readily determined from the enthalpy functions shown in Fig. 2 by means of graphical differentiation. Values of $(\delta H/\delta T)_p$ so determined were then plotted as "horizontal steps" against temperature and a smooth curve drawn through the steps in such a manner so as to balance the areas. The final family of curves for the constant pressure specific heats are presented in Fig. 3.

Discussion of Results

Since rigorous thermodynamic equations were used in this work, errors could come from only two possible sources:

(1) Errors inherent in the fundamental P-V-T data, zero-pressure specific heats, and possibly latent heat data.

(2) Plotting, smoothing and reading of graphical integrations and differentiations.

It is difficult to ascertain the accuracy of this work as no data exist in the literature with which to make relative comparisons. The application of the concept of residual volumes[3,6] would have, no doubt, increased the accuracy since, in some cases, slight changes in the temperature resulted in great changes in the slopes of the curves.

Acknowledgement

The author wishes to thank the Foster Wheeler Corporation for its generous attitude in permitting this work to be published.

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Nomenclature

C_p = specific heat, Btu/lb. ° F.
H = enthalpy, Btu/lb.
H_o = enthalpy at zero pressure at —100° F., Btu/lb.
p = pressure, psia.
R = gas constant.
S = entropy, Btu/lb. ° R.
S_o = entropy at zero pressure of ideal gas, Btu/lb. ° R.
V = specific volume, ft.³/lb.
T = temperature, ° R. or ° F.
Z = compressibility factor, $Z = pV/RT$.

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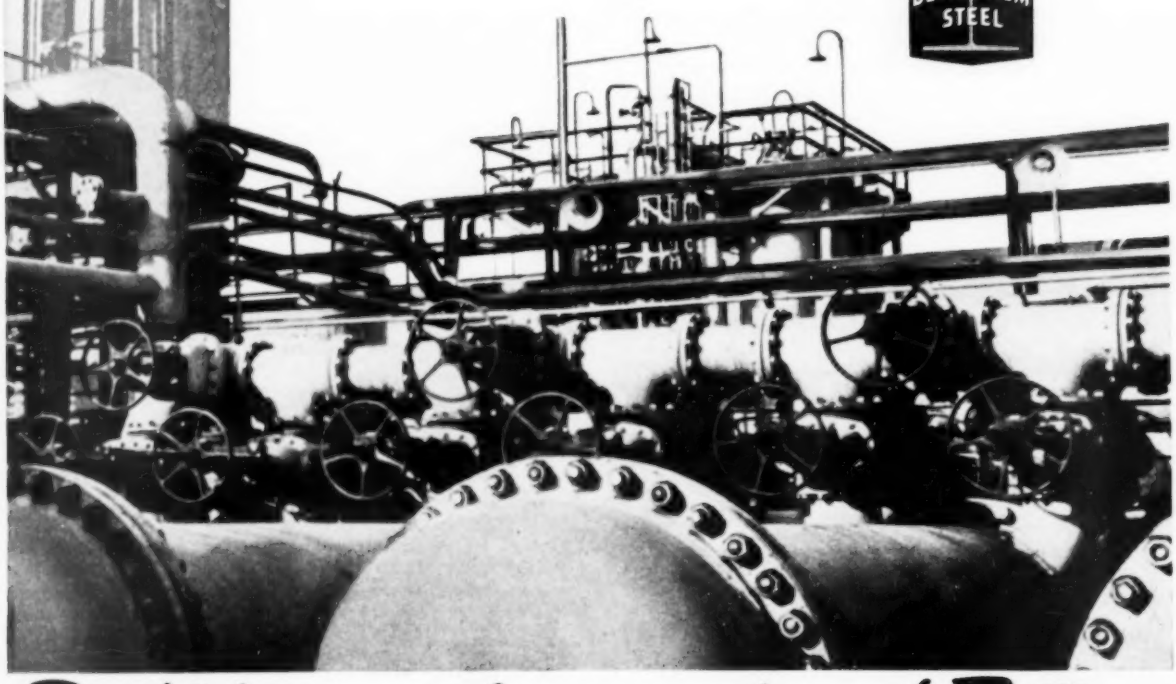

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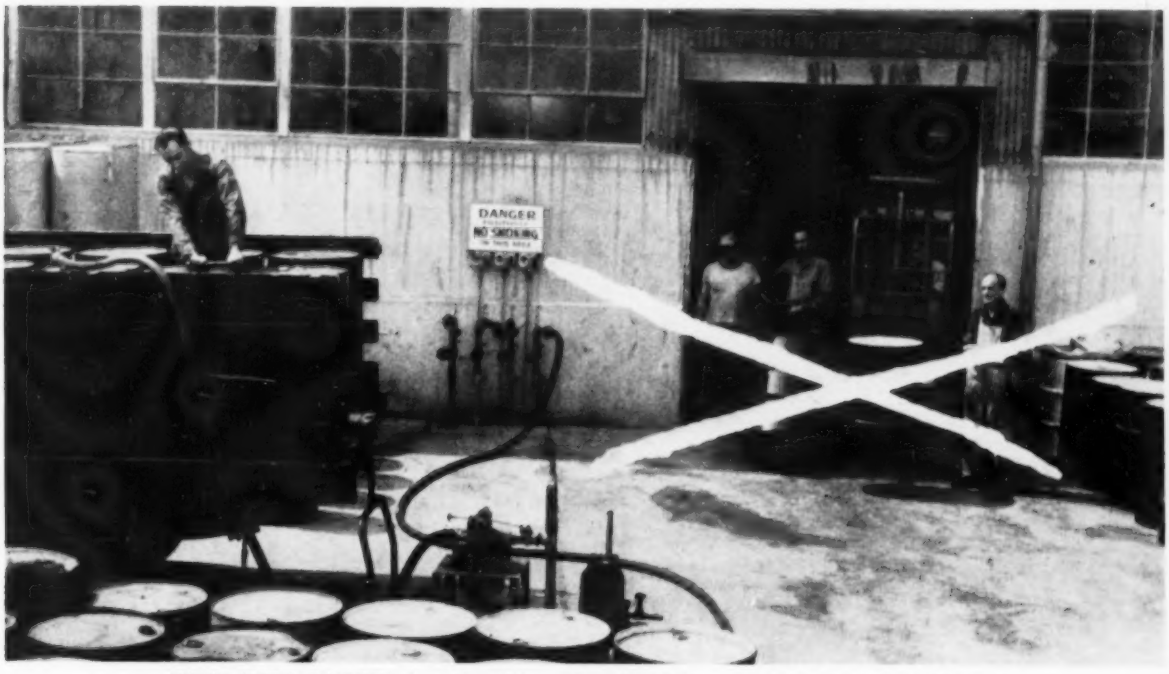


FOUR MEN GAINED for other jobs, when handling operation was eliminated by filling drums directly on the truck they came in on

Save Time, Men with Mobile Drum Filler

LESS THAN $1000, overall costs, and payout in one month for this shop-built automatic mobile drum filler

FOR less than $1000, a Los Angeles company has rigged up a mobile, automatic drum-filling device that is six times faster than the old way and has paid for itself in a month.

The company is Wilco, who have varied interests, including packaging of chemicals and lubricating oils. This particular case involved filling drums with liquid chemical products, but the system itself can be used wherever loading dock facilities are lacking, Wilco said.

The firm had accepted a service assignment from Shell Chemical Corp. to fill drums with products that Shell supplies and Wilco stores on its premises. Products were methyl isobutyl ketone, methyl ethyl ketone, acetone, and isopropyl alcohol. Shell's customers send their drums by truck to Wilco to be filled.

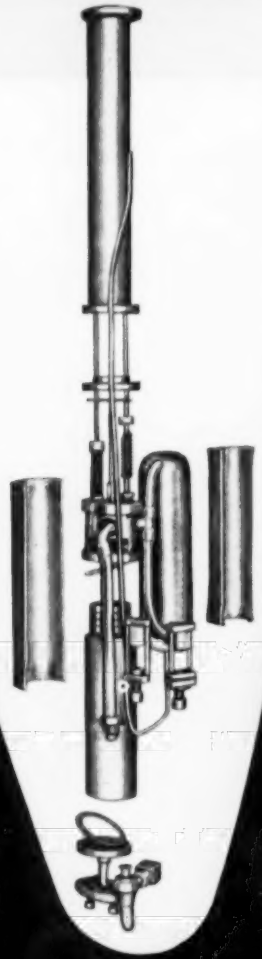
The old procedure was followed because Wilco had no convenient loading dock. When the truck load of, say, 75 drums arrived, they were moved by hand into the plant area. Next, they were moved inside the plant to the filling area. Then, they were moved by fork lift truck to the staging area until the order was filled. Finally, the following day, they were loaded onto the truck by

UNIQUE
PROTOTYPE DEVELOPMENT

. . . using advanced

Engineering Techniques

New ADL Mechanical Division Building



Designing expansion engines for gas liquefaction equipment to operate at *four hundred and fifty degrees below zero* Fahrenheit has its problems — lubrication is just one, contamination and isentropic efficiency, some others. Experience in many areas of engineering metallurgy and physics enabled ADL to design and produce expansion engines which greatly advanced this art.
ADL has the range of experience to develop such unique prototypes and world wide reputation for doing it successfully.

IF lack of personnel has halted development of your new ideas or new products, the ADL Mechanical Division can take over and bring them to complete maturity.

Arthur D. Little, Inc., has blended its scientific and engineering skills in the Mechanical Division to provide industry with a unique service . . . prototype development of equipment requiring a high level of engineering. Scientists in the fields of chemistry, physics, metallurgy, mathematics, biology, electronics and technical economics can be called on as required.

Our staff is experienced in interpreting the ideas of industry and following through with the perfection of specialized equipment.

THERMODYNAMICS · HEAT TRANSFER · REFRIGERATION TO MINUS 456°F. · VACUUM ENGINEERING · GAS LIQUEFACTION · ELECTROMAGNETISM · MECHANICAL DESIGN · VIBRATION

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MECHANICAL DIVISION

Arthur D. Little, Inc.

CREATIVE TECHNOLOGY SINCE 1886

ADL
Mechanical Division

30 MEMORIAL DRIVE, CAMBRIDGE 42, MASS.

fork lift—a procedure alone requiring 75 round trips or five or six hrs.

Four men were involved in the complete operation: a general helper removing empties from the truck, a general helper transferring them inside, a blender filling the drums, and the fork lift operator.

Some 20 to 24 man-hours were used up by the operation: two men working two hours to unload the drums, a blender and helper putting in 10 hours between them, and the re-loading which took six hours, and occasionally more.

Wilco's officials decided that the procedure was both inefficient and costly. The problem centered around the lack of a loading dock. Among the suggested solutions were construction of a loading dock or use of an existing dock area located at another part of the plant. A new dock would have been a big expense. Use of the other dock wouldn't eliminate the multiple handling and transfer of drums.

Plant manager S. Jerome Tamkin came up with the suggestion of filling the drums right on the truck they came in on. For equipment, Wilco bought a Bowser automatic meter-filler with a de-aerator attached to remove air from the lines before metering, and mounted it on a standard dolly cart. A 1½-in. hose runs from the products nozzle to the de-aerator, and another one is attached to the meter for use in filling the drums.

The new procedure takes about 2½ hours, but it could be done even faster. The incoming truck brings 75 drums, standing upright, with top-entry bungs. The new mobile filling unit is attached to one of the four products pipes, located against the outside wall of the plant in the truck area. One man mounts the truck, carrying the hose attached to the meter. He removes a bung, inserts the hose, and pulls the switch, starting the flow of a predetermined quantity, controlled automatically.

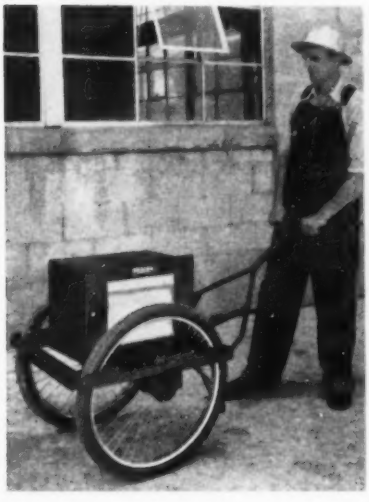
While a drum is being filled, he replaces the bung on the previously-filled drum and removes one from the next, a continuous procedure.

The filling meter is a type which is calibrated according to products being handled. It has an automatic temperature compensator, which is regulated on the basis of temperature indications by a thermometer mounted at the meter inlet.

One minute per drum is the top speed possible with the new procedure, when filling standard 52-gal. drums. Thus a load of 75 drums could be filled in almost 1¼ hours; however, Wilco allows 2 to 2½ hours, according to Tamkin. The firm used to allow two days overall time for the complete job. Now, it can handle three 75-drum loads in one day.

Total cost was less than $1000, including equipment, labor, and accessories. By reducing each loading job an average of 17 hours, a savings of $30 to $35 is effected; thus payout can be realized in 30 jobs. In addition, the men previously required for the old procedure are made available for other work, and stand-by time for the trucker is reduced.

The new method is safe, insofar as fire hazard is concerned. Pump and motor are mounted near the storage tanks, so no electrical equipment is involved at the filling point.



Utility Cart Helps Instrument Men

TWO BIKE wheels, some strap and some angle iron, a few lengths of tubing—properly assembled, as shown in the photographs, make up a neat and handy small utility cart. Designed and built for use by the instrument shop at the Cleves, Ohio, refinery of Gulf Refining Co., the carrier was made particularly for transportation of delicate instruments such as the recording pyrometer in the picture.

However, it has been found much more versatile and rugged than was originally conceived, and it is now used to haul every conceivable load up to 300 lb. or so. An old L&N pyrometer case will fit exactly on the bed of the cart, providing a box for carrying small objects. Control valves and flow instruments are frequent "passengers."

The convenience and time-saving involved in not having to wait for a regular refinery truck is obvious. In addition, the cart can be made to go into many places not accessible to a truck. The overall width was limited carefully to permit the cart to roll over even the narrowest walkways in the refinery. The cart was designed by James Ross, Instrument Man No. 1, and fabricated by Earl Knight, Welder No. 1.

How to Clean Condenser Tubes in-place with Air

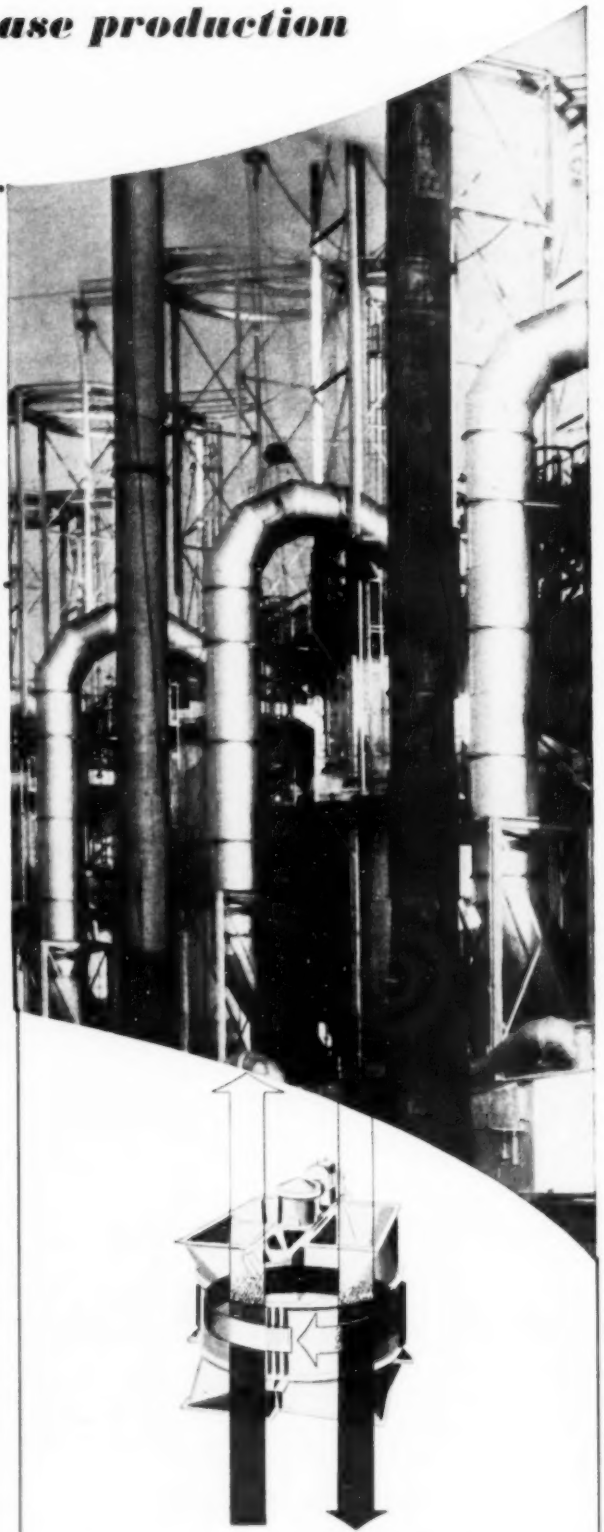
COMPRESSED air to clean condensers "in-place" has been used to advantage by Esso Standard Oil Co. at the Baltimore, Md., refinery.

The steam turbines driving the air blowers (to the regenerator of the catalytic cracking unit) exhaust to a pair of river water-cooled condensers. Algae and silt gradually foul up the condenser tubes, resulting

Reduce slag...increase production

with the

Ljungstrom Air Preheater



Slag – primary cause of reduced capacity – can be practically eliminated by the use of a Ljungstrom Air Preheater.

That's because preheated air mixes more thoroughly with the fuel. Therefore, less excess air is required for complete combustion – and less combustible material is lost in the flue gases.

Thus, with a Ljungstrom Air Preheater, there is less material present in the furnace for slag production. Oil tubes stay cleaner . . . longer. Stills stay on stream *at top production* for months longer.

For example, a pipe still in an eastern refinery dropped from 16,000 barrels a day to 12,000 because of slag. Now, with a Ljungstrom Air Preheater and modern high-temperature burners, the still operates *continuously at 18,000/20,000 barrels.*

This saving alone can pay for a Ljungstrom installation in less than a year. Add it to more economical furnace design possible . . . up to 20% fuel savings . . . greater heat recovery even from low grade fuels . . . higher through-put – and you can see why the Ljungstrom Air Preheater is perhaps *the most significant guidepost to economy available today to refiners.*

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits attainable in your fuel burning equipment – call or write The Air Preheater Corporation today.

The Ljungstrom operates on the continuous regenerative counter-flow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

The Air Preheater Corporation

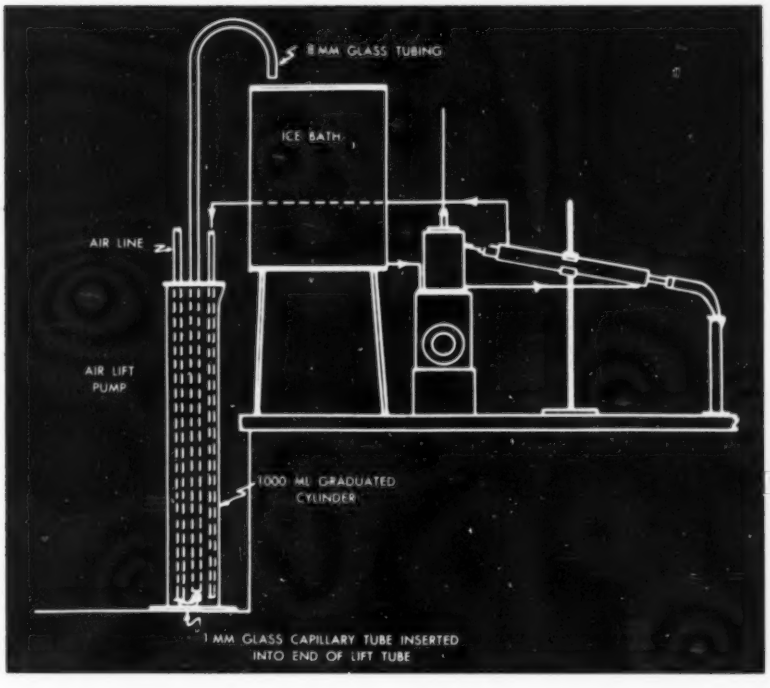
60 East 42nd Street, New York 17, N. Y.

WHEREVER YOU BURN FUEL, YOU NEED LJUNGSTROM

eventually in a reduction of the vacuum necessary to maintain proper blower speed. The condensers would finally have become so completely plugged that it would be preferable to retube them rather than clean the tubes.

Instead, an air hose has been connected to a tap in the water inlet to the condensers, and 125 psi. air is admitted for a short period of time. This has been shown to clean the tubes sufficiently to increase the vacuum to approximately its original value, thus permitting normal blower operation.

LABORATORY PRACTICES


8 MM GLASS TUBING
ICE BATH
AIR LINE
AIR LIFT PUMP
1000 ML GRADUATED CYLINDER
1 MM GLASS CAPILLARY TUBE INSERTED INTO END OF LIFT TUBE

Air-Lift Pump Useful in the Lab

By H. D. COE*

A SIMPLE air-lift pump for small volumes of liquids at low head has been found a most useful "tool" in the gasoline plant laboratory of Sun Oil Co. at Delhi, La. It is illustrated in the accompanying sketch.

A 1000-ml. graduate serves as a small accumulator basin and jacket for the pump. The lift tube is constructed of 8-mm. diameter glass tubing about 100 cm. long, bent as shown in the drawing. A small stream of air is introduced through a 1-mm. glass capillary tube into the lift tube, providing the necessary energy used in the pumping operation. The amount of air needed depends upon the volume of liquid being pumped. For a constant air supply, there will be a constant liquid head maintained in the jacket, and the volume of liquid being pumped is dependent upon this head.

The pump operates as a result of two principles in combination. At low air settings, the density of the fluid in the lift tube is decreased. Because the density of the fluid in the outer jacket is greater, the level of the fluid within the lift tube is raised so as to equalize the difference in the two heads. This difference in fluid densities causes the flow of fluid from the pump to a receiving vessel. At higher air rates and lower heads in the outer jacket, the difference in density principle is replaced to a great extent by the simple function of jet action of the air in the lift tube. The most efficient operation is obtained at lower air settings.

* Mr. Coe is associated with Sun Oil Co., Delhi, La. This short article is based on his prize-winning idea as presented during the "Plant Kinks" session at the Tyler, Texas, meeting of the Natural Gasoline Ass'n. of America, October 24, 1952.

More Accurate Level Reading of LOW TEMPERATURE LIQUIDS . . .
JERGUSON
Large Chamber
NON-FROSTING* GAGES

YOU get the highest possible accuracy of reading on low temperature, low boiling point liquids with the patented Jerguson Non-Frosting Gage in the New Large Chamber model . . . because it insures less turbulence at the meniscus, and clear vision at the vision slot.

This new Jerguson model has 6 times larger area at the meniscus than the standard gage, so that there is a marked reduction in turbulence with light gaseous fluids that tend to boil or surge. Moreover, the problem of frosting encountered with these liquids has been eliminated by a patented frost preventing unit extending from the gage glass. This special transparent unit projects beyond the cover bolts and prevents frost from building up over the vision slot.

Here's a dual feature gage that assures greatly increased accuracy of reading for the process industries. If you have a problem with light gaseous fluids, or with gage frosting, it will pay you to investigate the new Jerguson Large Chamber Non-Frosting Gage . . . reflex or transparent.

Jerguson Large Chamber Gage, Transparent Type, with the patented Non-Frosting Gage Glass Extension. Write for literature on this gage, and on other non-frosting Jerguson models.

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(To obtain more data on advertised products see page 600)

Now Available

Samples of New Du Pont Fuel Oil Additive No. 2

Fuel oil stabilization has often proved difficult and expensive since the usual oxidation inhibitors used in gasoline, greases and lube oils have little effect on fuel oils.

Because fuel oils can cause filter screen clogging, stabilizing them is important from a customer relations as well as quality standpoint.

If you have such a stabilizing problem, the chances are that Du Pont Fuel Oil Additive No. 2 can help solve it. This new ashless additive was developed especially as a dispersant and stabilizer for distillate fuel oils. Being highly effective, it gives desired results at low cost.

TO PREVENT CLOGGING, Fuel Oil Additive No. 2 not only acts to retard the formation of insoluble residues, but also reduces the particle size of those insoluble residues that are formed.

Through use of the new additive, catalytic cracked stocks of the proper boiling range can be blended with straight-run products at no sacrifice in the field performance of the blend. This helps to increase yield and flexibility.

SAMPLES of Du Pont Fuel Oil Additive No. 2 are available for testing in your own stocks. Any Du Pont Petroleum Chemicals Division representative or district office will be glad to supply you.

EFFECT OF FOA NO. 2 ON SCREEN CLOGGING
FOA NO. 2 ADDED PRIOR TO AGING
CONTROL
0.010 WT. % FOA NO. 2
OIL A AGED 6 MONTHS AT 110°F IN DARK
CONTROL
0.020 WT. % FOA NO. 2
OIL B AGED 9 MONTHS AT ROOM TEMPERATURE

THESE FOUR FILTER SCREENS show clearly the improvement in two oils to which Du Pont Fuel Oil Additive No. 2 has been added.

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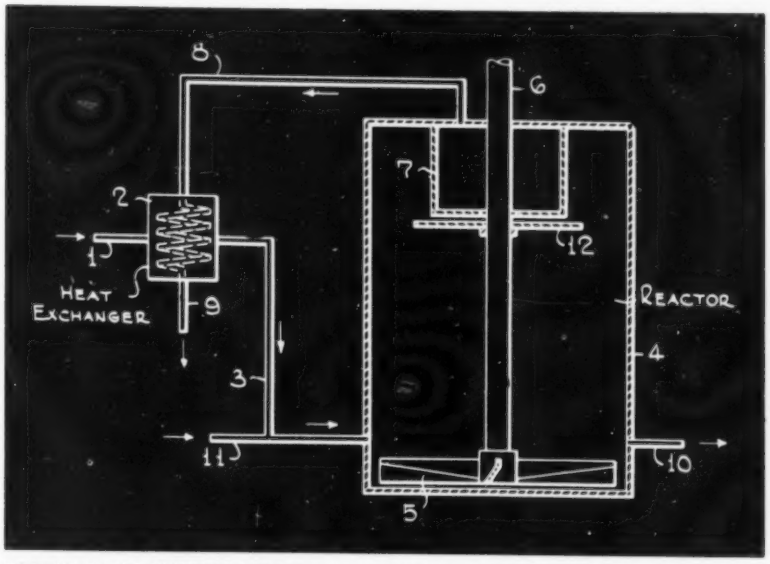
By Peter J. Gaylor, *Patent Attorney, Gaylor, Cifelli & Jurick, Newark, N. J.*



SLURRY POLYMERIZATION with fluidized phosphoric acid catalyst diluted with partially deactivated silica gel (Standard Oil Development Co.—U. S. 2,626,293)

Diluent Reduces Catalyst Deactivation in Slurry Polymerization of Light Olefins

IN ORDER to overcome problems in catalyst deactivation and unsatisfactory temperature control in C_3-C_4 olefin polymerization, it has been suggested that a fluidized solid or slurry type operation be employed with finely divided catalyst suspended or slurried in the fluid reactants. However, although little catalyst agglomeration occurs in such operations, the catalyst loses activity fairly rapidly.

In its U. S. patent 2,626,293, Standard Oil Development Co. discloses a way to overcome such loss in activity by partially deactivating the silica gel before using it as a catalyst diluent. This deactivation results in a reduction in surface area.

The range of surface area over which silica gels are effective is 50-300 $m.^2/g.$, while the preferred range of surface area is 100-250 $m.^2/g.$ Silica gels in this general range of surface area can be obtained by heating fresh silica gel for ¾-2 hrs. at 1800° F.

The amount of silica gel diluent used in co-suspension depends on the agglomerating tendencies of the catalyst, but in general will range from about 10% to 50%. With 80% phosphoric acid on 20% kieselguhr as the polymerization catalyst, the preferred concentration of silica gel diluent is between 15-25%.

In the process of producing normally liquid hydrocarbons from propylene-butylene fractions, the feed is passed upwardly through a finely divided mechanically stirred polymerization catalyst of 40 mesh or finer in which silica gel is co-suspended as a diluent at 350°-600° F. and about 1000 psi., at a velocity of 1-2 fpm. With such operation, the olefin fraction is thoroughly mixed with the catalyst, which is kept in suspension with the material being polymerized. The pressure is kept above the critical to avoid the co-existence of a gaseous and a liquid state. Under such conditions, the olefins are in a nebulous state wherein it is difficult to tell whether the material is liquid or gaseous since the change from one to the other occurs gradually without discontinuity. So it is possible to call the mass a slurry or a fluidized mass.

As can be seen from Fig. 1 the normally gaseous C_3-C_4 fraction containing say 50% paraffins and 50% olefins which latter are divided into 50% propylene and 50% butylene, is introduced at 100° F. and 1000 psig. through line 1 to heat exchanger 2, where it is heated to 250° F. The heated feed then is fed through line 3 into the bottom of reaction zone 4 maintained at 1000 psig. and 450° F. This zone contains a finely divided catalyst consisting of phosphoric acid on kieselguhr of about 40-100 mesh. The feed is introduced upwardly through this catalyst at 0.25 to 2.5 gph-lb. catalyst and is agitated by stirrer 5 rotating on shaft 6 so that the catalyst is maintained in suspension in the feed. Thus, the more dense catalyst particles will lag behind the less dense olefins and the catalyst will concentrate in the lower portion of the reaction zone in a dense phase mass which acts as if it had a level similar to a boiling liquid.

To prevent agglomeration of the catalyst, there is co-suspended with it about 10-50% by weight of finely divided partially deactivated silica gel of 40-100 mesh. Regular quantities of water may be introduced to maintain the catalyst in proper state of hydration.

The products from zone 4 are removed through shroud 7 by line 8 and passed through heat exchanger 2 where they give up heat to the incoming feed. The cooled products then are led through line 9 to any desired fractionating or stabilizing means. From time to time catalyst is removed from reaction zone 4 through line 10 and burned or otherwise disposed of. Makeup catalyst is added through line 11. The process thus is non-regenerative. A rotating baffle 12 is attached to shaft 6 just below shroud 7 which is an enlarged outlet, the cross sectional area of which is such that the rate of flow of the effluent therethrough is less than the settling rate of the catalyst. This, together with the baffle, helps keep the catalyst from being thrown into the shroud and the rotation prevents the catalyst from settling on the baffle.

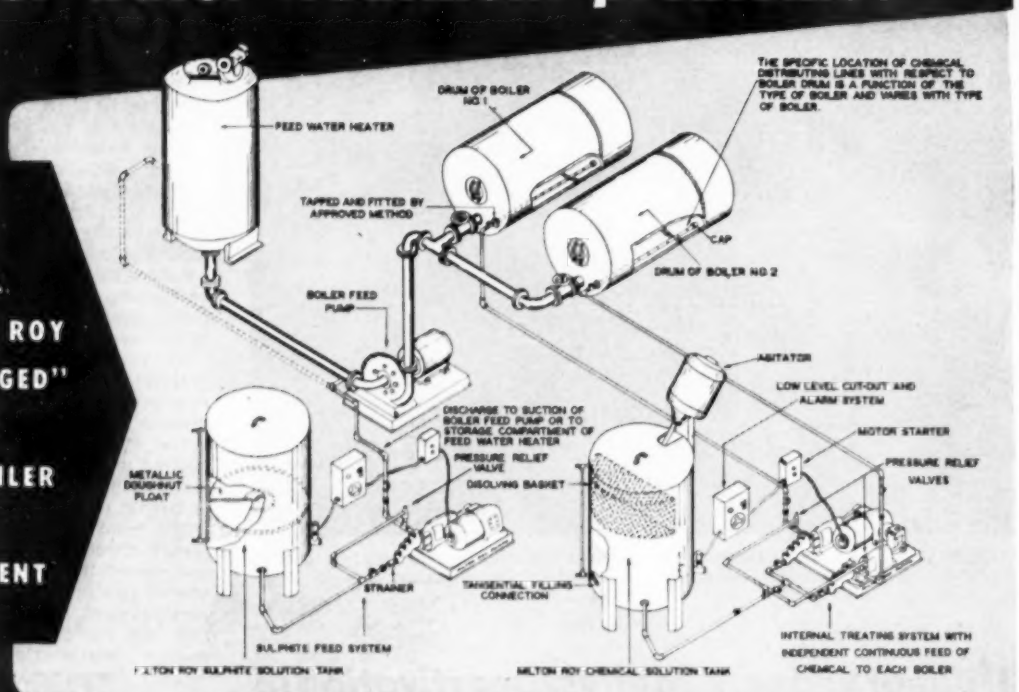
The table below presents data with silica gels deactivated to different extents and used in polymerizing a C_4 feed containing 43.1% olefins at 450° F. and 1000 psi. using, as catalyst, phosphoric acid supported on kieselguhr. The silica gel used amounted to 20% of the catalyst mixture.

Run No.	Surface area of gel, $m.^2/g.$	Olefin conv. weight percent	Condition of used Catalyst
1	0.5	76	Agglom.
2	180	87	Free
3	235	86	Free
4	450	79	Free

The fresh silica gel used in the experiments had a surface area of about 650 $m^2/g.$ The gels used were heated at temperatures of 1600-1800° F. for varying lengths of time to give the surface area shown in the table. It is evident from the table that silica gels of low and high sur-

Here's a sure "system" for beating boiler water treatment problems!

IT'S A TYPICAL MILTON ROY "PACKAGED" SYSTEM FOR BOILER WATER TREATMENT


FEED WATER HEATER
DRUM OF BOILER NO. 1
THE SPECIFIC LOCATION OF CHEMICAL DISTRIBUTING LINES WITH RESPECT TO BOILER DRUM IS A FUNCTION OF THE TYPE OF BOILER AND VARIES WITH TYPE OF BOILER.
TAPPED AND FITTED BY APPROVED METHOD
CAP
DRUM OF BOILER NO. 2
BOILER FEED PUMP
AGITATOR
LOW LEVEL CUT-OUT AND ALARM SYSTEM
DISCHARGE TO SUCTION OF BOILER FEED PUMP OR TO STORAGE COMPARTMENT OF FEED WATER HEATER
MOTOR STARTER
PRESSURE RELIEF VALVE
METALLIC DRUM-SHUT FLOAT
DISSOLVING BASKET
PRESSURE RELIEF VALVES
STRAINER
TANGENTIAL FILLING CONNECTION
SULPHITE FEED SYSTEM
INTERNAL TREATING SYSTEM WITH INDEPENDENT CONTINUOUS FEED OF CHEMICAL TO EACH BOILER
MILTON ROY SULPHITE SOLUTION TANK
MILTON ROY CHEMICAL SOLUTION TANK

IN these days of insistence on production efficiency, engineers turn to Milton Roy for *dependable* continuous treatment of boiler feed water. Here are just a few reasons why:

Milton Roy automatic "packaged" systems are engineered by specialists in Controlled Volume Pumping. The use of Milton Roy Controlled Volume Pumps in these systems is positive assurance of precision control and metering of chemicals at any pressure requirement. The patented non-clogging liquid end step-valve design of these pumps contributes materially to the efficiency of the system. Power plants and public utilities, both large and small, attest the record of uninterrupted service supplied by Milton Roy pumps and equipment.

These packaged systems are custom engineered to specifications. All necessary accessory equipment is supplied—solution tanks, covers, gage glasses, low-level cut-outs and alarms, motor starters and agitators as needed. Obvious benefits result from using one source of supply.

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face areas are unsuitable for use as diluents. However, gels of intermediate surface area are quite satisfactory. It is believed that the silica gels are effective in preventing agglomeration by adsorbing high molecular weight, hydrogen-deficient polymers which otherwise would be adsorbed on the catalyst, making the catalyst particles stick together. If the gel has too high a surface area, it not only adsorbs high molecular weight polymers, but also free acid from the catalyst. In such case, there is no catalyst agglomeration but the catalyst gradually loses activity.

Hydroperoxide in Jet Fuel Reduces Carbon Deposits

EARLY fuels for turbojet use have been of low aromatic content and in the kerosene boiling range. However, with the increased use of jet engines, the problem of supply has been an important factor, and there has been a gradual liberalization of the specifications with respect to aromatics, olefins and sulfur. This changing of fuel specifications has imposed problems of engine carbon deposits.

In its U. S. Patent 2,609,279, Standard Oil Development Co. reports that such carbon deposition obtained with highly aromatic fuels can be greaty reduced by adding 0.1-5% of a hydroperoxide. In one example, a jet fuel containing 99% aromatics deposited 52.6 gms. of carbon in a GE I-40 single combustor engine operated for a definite period under controlled conditions. When 2% cumene hydroperoxide was added to the same fuel, the total engine deposit under the same operating conditions amounted to only 19.9 grams, a reduction of 62%. The peroxide had substantially no effect on carbon deposition with non-aromatic fuel.

Oil Soluble Sulfonates Of High Metal Content

A SERIES of patents (2,616,904-6, 2,616,911, and 2,616,924-5) was issued to Lubrizol Corp., describing the preparation of alkaline earth metal complexes containing a higher amount of oil soluble metal (such as barium) than in normal soaps. In one example, the barium salt of petrolatum sulfonic acid and p-tert.butyl phenol are heated to 95° C., and to this mixture is added a barium oxide-water slurry. The mixture is refluxed for one hour and the temperature is raised to 160° C. to remove all water. A viscous liquid sulfonate containing a basic number of 23.1 and metal ratio of 1.7, and soluble in 150 neutral oil, is obtained.

Patents Issued in February

The following classified listing gives the patent number, patentee or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for February 3, 10, 17, and 24, 1953, Vol. 667, Nos. 1-4.

PROCESSES

Catalysts

2,627,506 (Standard Oil Development Co.) Preparation of metal oxide co-gel catalysts.

Conversion

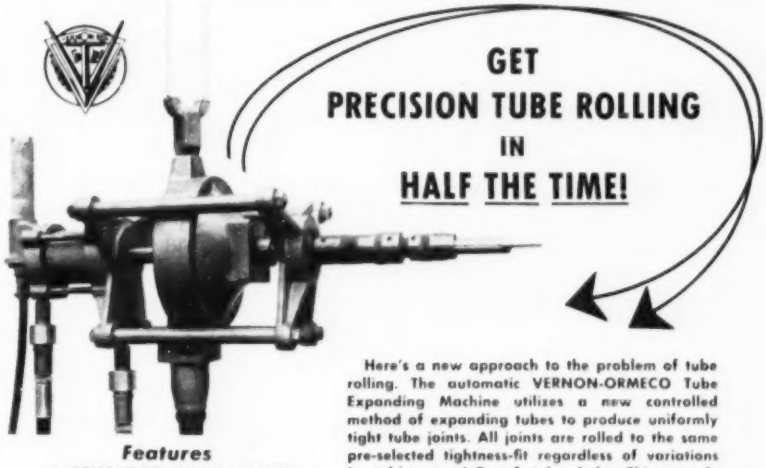
2,627,455 (Union Oil Co. of Calif.) Coal Gasification process and apparatus.
2,627,495 (Phillips Petroleum Co.) Hydrogenolysis process for the production of a good quality gas oil and gasoline from a heavy residuum hydrocarbon oil, using solvent which selectively dissolves aromatics.
2,627,499 (Standard Oil Development Co.) Catalytic distillation of shale.
2,628,157 (Sinclair Refining Co.) Catalyst regenerator.
2,628,158 (Sinclair Refining Co.) Catalyst stripping vessel.
2,628,159 (Fisher Scientific Co.) Liquid-gas contact apparatus.
2,628,188 (Houdry Process Corp.) Hydrocarbon conversion process utilizing the gas lift as the conversion zone.
2,628,893 (Houdry Process Corp.) Disengagement of gases from a moving bed of fluent solid particles.
2,628,932 (Sinclair Refining Co.) Pyrolytic conversion of hydrocarbons with the aid of a fluid catalyst.
2,629,683 (Universal Oil Products Co.) Catalytic reforming process employing platinum on alumina.
2,629,684 (Universal Oil Products Co.) Method and apparatus for effecting the catalytic conversion of an organic reactant stream, particularly a liquid charge, using finely divided catalyst.
2,629,754 (Phillips Petroleum Co.) Method of isomerizing paraffins with aluminum halides and cisdecalin.

Hydrocarbon Synthesis

2,627,522 (Standard Oil Development Co.) Method and apparatus for carrying out hydrocarbon synthesis exothermic catalytic reactions.
2,628,161 (Phillips Petroleum Co.) Fluidized iron oxide-natural gas process for manufacturing synthesis gas.
2,628,890 (Hercules Powder Co.) Process for the decomposition of hydrocarbons to hydrogen and carbon oxides, using steam and nickel.
2,628,968 (Standard Oil Development Co.) Reduction of carbon formation in hydrocarbon synthesis.
2,628,969 (Ruhrchemie Aktiengesellschaft) Iron catalyst for the hydrogenation of carbon monoxide.
2,628,970 (Hydrocarbon Research, Inc.) Synthesis of liquid hydrocarbons.
2,629,728 (United States of America) Iron nitride catalysts in carbon oxide hydrogenations.
2,629,729 (Hydrocarbon Research, Inc.) Hydrocarbon synthesis.

Refining

2,627,318 (Socony-Vacuum Oil Co.) Refrigeration method of recovering hydrocarbons from gas mixtures.
2,627,397 (Phillips Petroleum Co.) Bubble cap assembly for fractionating apparatus.
2,627,496 (Stratford Engineering Corp.) Process for washing acid treated lubricating oil distillate.
2,627,497 (Phillips Petroleum Co.) Pebble heater apparatus and method for heat exchange.



GET
PRECISION TUBE ROLLING
IN
HALF THE TIME!

Here's a new approach to the problem of tube rolling. The automatic VERNON-ORMECO Tube Expanding Machine utilizes a new controlled method of expanding tubes to produce uniformly tight tube joints. All joints are rolled to the same pre-selected tightness-fit regardless of variations in tubing or I. D. of tube hole. This greatly reduces the danger of leakage and speeds maintenance and manufacturing jobs.

The VERNON-ORMECO Tube Expanding Machine provides an exceptionally rapid operating cycle and is extremely simple to operate.

Features
- ROLLS UP TO 700 TUBE JOINTS PER HOUR.
- ROLLS ALL TUBES UNIFORMLY TIGHT TO PRE-SELECTED TIGHTNESS-FIT.
- OPERATES IN RAPID AUTOMATIC CYCLE.
- REDUCES DOWN-TIME AND INCREASES TOOL LIFE.

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TUBE EXPANDING MACHINE

VERNON TOOL CO., LTD.
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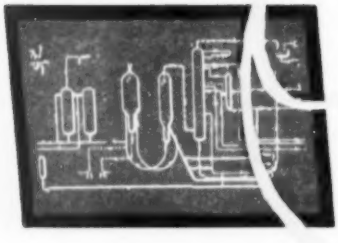
Vernon "Universal" FLAME CUTTER
Brown STEEL VALVES
Vernon-Ormeco TUBE EXPANDING MACHINE

Foster Wheeler

"know how" is a catalyst . . . . .

...that expedites conversion from a flow diagram to a complete refinery.



This catalyst is the product of a precisely controlled integration of the functions of design, engineering, fabrication and construction. Its essential characteristic is service.
It has saved and is saving Foster Wheeler clients time and money.

FOSTER WHEELER

Complete engineering facilities
at New York, Paris, London,
St. Catharines, Ontario and Houston, Tex.

Patents

2,627,513 (Standard Oil Development Co.) Segregation of hydrocarbons with urea at low temperatures in presence of less than 5% methanol.
2,627,731 (Hydrocarbon Research, Inc.) Rectification of gaseous mixtures.
2,627,933 (Sinclair Refining Co.) Aerogel diffusion unit.
2,628,894 (George J. Langmyhr) Countercurrent extraction method and apparatus.
2,628,933 (California Research Corp.) Regeneration of solid adsorbent.
2,628,990 (Standard Oil Development Co.) Separation and recovery of naphthenic hydrocarbons from mixtures thereof, using furfural.
2,628,991 (Standard Oil Development Co.) Removal of boron fluoride from reactive hydrocarbons.
2,629,239 (Universal Oil Products Co.) Separation of closely boiling fractions from a binary mixture by superatmospheric fractionation.
2,629,460 (Phillips Petroleum Co.) Process for the dehydration of fluids, using adsorbent.
2,629,654 (Shell Development Co.) Method and apparatus for contacting fluids.
2,629,730 (Socony-Vacuum Oil Co.) Solvent extraction process using acetonitrile.
2,629,747 (Standard Oil Development Co.) Spent acid restoration process.

PRODUCTS

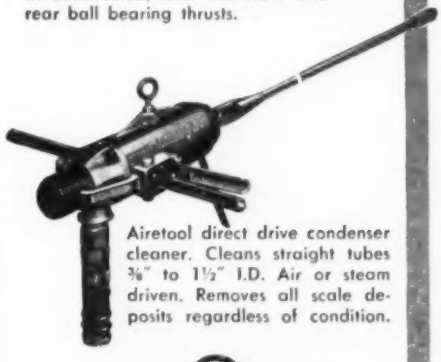
Chemicals

2,627,524 (Jefferson Chemical Co.) Hydroxy carbamates and process of producing same.
2,627,527 (Standard Oil Development Co.) Oxidation of olefins to alkenals, using cupric oxide.
2,628,198 (Standard Oil Development Co.) Alkyl maleate-vinyl acetate copolymers.
2,628,200 (Phillips Petroleum Co.) Production of alkaryl sulfonate detergent compositions, including a method of controlling the sodium sulfate content thereof.
2,628,203 (Standard Oil Development Co.) Solutions of rubbery polymers from particles of uniform diameter.
2,628,207 (Standard Oil Development Co.) Terephthalate esters as plasticizers for polyvinyl resins.
2,628,212 (Standard Oil Development Co.) Stabilized synthetic rubber compositions containing 2,2-bis(2-Hydroxy-3-t-butyl-5 methylphenyl)-propane.
2,628,220 (Standard Oil Development Co.) Alkyl maleate-vinyl ester copolymer.
2,628,222 (Shell Development Co.) Method of polymerization and products produced thereby.
2,628,225 (Standard Oil Development Co.) Polymerization of methacrylate esters with benzoyl peroxide-benzoin-ferric laurate catalyst.
2,628,934 (Shell Development Co.) Separation of hydrogen halides from olefinically unsaturated compounds.
2,628,965 (General Aniline & Film Corp.) Preparation of olefin oxides, using fluidized bed.
2,628,985 (Shell Development Co.) Production of phenols.
2,628,986 (Shell Development Co.) Alcohol purification process.
2,629,708 (Phillips Petroleum Co.) Emulsion polymerization of vinylidene compounds in the presence of hydrazine-polyaminecarbamate compositions.
2,629,709 (Phillips Petroleum Co.) Emulsion polymerization of vinylidene compounds in the presence of carbamates of polyamines.
2,629,731 (Shell Development Co.) Esters of phosphonoformic acids and polyhydric alcohols.
2,629,735 (Standard Oil Development Co.) Reaction of ethers with acids using ion exchange resins catalysts.
2,629,748 (Phillips Petroleum Co.) Production of 9-chloro or 9-bromodecalin.
2,629,749 (Universal Oil Products Co.) Production of halobicycloalkyl aromatic compounds.
2,629,753 (Dow Chemical Co.) Making ethylene by catalytic pyrolysis of ethane.

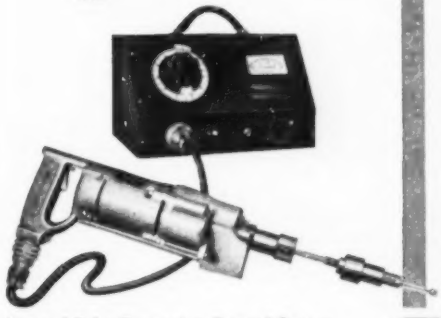
Fuels

2,628,189 (Tide Water Associated Oil Co.) Gas turbine and jet liquid fuel composition and process of making same.
2,628,475 (Socony-Vacuum Oil Co.) Jet combustion device embodying pretreatment of fuel before combustion.
2,628,600 (The Texas Co.) Control of the ignition means in injection type internal-combustion engines.
2,628,895 (The Indium Corp. of America) Motor fuel additive (indium laurate).
2,628,981 (Standard Oil Co.—Ind.) Prepara-

Airetool ball bearing motor with single expansion cutter head for cleaning straight tubes. Motor is slip-fit constructed, and has front and rear ball bearing thrusts.



Airetool direct drive condenser cleaner. Cleans straight tubes ⅜" to 1½" I.D. Air or steam driven. Removes all scale deposits regardless of condition.



Airetool Tube Expansion Control System automatically, accurately rolls tube joints. Eliminates danger of over or under expansion. For field, shop or new work.

Scaled tubes and leaky tube joints cut capacity, increase operating costs. AIRETOOL tube cleaners and tube expanders keep tubes at peak efficiency, reduce down-time due to tube failures. Powerful, high speed cleaners quickly and thoroughly remove even the hardest deposits from straight or curved tubes. Tight, leak-proof tube joints can be assured everytime, when they are rolled automatically, accurately, with the unique AIRETOOL Tube Expansion Control System.

You'll have an improved tube maintenance program and better tube efficiency if you specify AIRETOOL tube cleaning and tube expanding equipment. Do it today. Literature upon request.

There's an Airetool Tube Cleaner and Tube Expander For Every Type of Tubular Construction.

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MANUFACTURING COMPANY
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BRANCH OFFICES: New York • Chicago Philadelphia • Houston • Tulsa • Baton Rouge • Hudson Heights (N.J.)
REPRESENTATIVES in principal cities in U.S.A., Canada, Mexico, South America

(To obtain more data on advertised products see page 600)

"Automatic" Sprinkler

10 point FIRE PROTECTION

spells the difference between

PROFIT and LOSS!

This scene of a refinery and storage district going up in smoke and flames is repeated all too often in petroleum properties. Fortunately, this one was halted before it reached disaster proportions. Newspapers referred to it as a "half million dollar blaze." But, they were only talking about the buildings and equipment. They didn't refer to losses in terms of out-of-service time, decreased production, inflated costs of rebuilding and replacement, vanishing profits. No, those losses are intangible—yet, just as real, just as eminent as the physical cost of fire destruction.

"Automatic" Sprinkler 10 Point Fire Protection is an absolute safeguard against fire loss, tangible and intangible. It's a profit making service that saves you money whether you have a fire or not . . . saves your business if you do!

Get The Facts: Write for informative 36-page booklet, "The ABC of Fire Protection." It's free!

"Automatic" Sprinkler

CORPORATION OF AMERICA · YOUNGSTOWN, OHIO

OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

Patents

tion of improved motor fuel, copolymer reacted with CO-H_2.

2,629,685 (Standard Oil Development Co.) Aviation fuel containing aromatic extract of kerosene.

Lubricants

2,627,511 (Standard Oil Development Co.) Antioxidant for petroleum products (reaction product of aryl sulfonyl halide and alkali metal mercaptide).

2,627,528 (Socony-Vacuum Oil Co.) Fluorine-containing lubricant.

2,628,195 (Leffingwell Chemical Co.) Lubricating grease using soap of stearic acid and 2-ethyl hexanoic acid.

2,628,196 (Socony-Vacuum Oil Co.) Fluorine-containing lubricant.

2,628,197 (Socony-Vacuum Oil Co.) Metal working lubricant containing bentonite.

2,628,202 (Leffingwell Chemical Co.) Soap useful for making lubricating greases (see 2,628,195).

2,628,938 (Phillips Petroleum Co.) Production of greases using reaction products of alpha-hydroxy fatty acids.

2,628,939 (Monsanto Chemical Co.) Mineral oil composition containing P-S compound to reduce wear.

2,628,940 (Standard Oil Development Co.) Extreme pressure lubricant (P-S compound).

2,628,941 (Shell Development Co.) Extreme pressure lubricant (imine-sulfide reaction product).

2,628,942 (The Texas Co.) Lubricating oils containing metal derivatives of cyclic imides.

2,628,949 (Socony-Vacuum Oil Co.) Stabilized lithium base grease.

2,628,974 (The Texas Co.) Polyester synthetic lubricants.

2,629,691 (Shell Development Co.) Colloidal oxide gel grease manufacture.

2,629,692 (Standard Oil Co.—Ind.) Grease containing sulfonate.

2,629,693 (Shell Development Co.) Lubricating composition containing calcium sulfonate.

2,629,694 (Shell Development Co.) Grease composition containing amine and diethiocarbamate soaps.

2,629,695 (Shell Development Co.) Manufacture of lithium lubricating greases.

2,629,721 (N. I. Malmstrom & Co.) Sulfurized fatty and waxy materials.

Specialties

2,627,474 (The Texas Co.) Rust preventive compositions containing a wax-soap (waxate) base.

2,627,479 (Lee Pritzker) Synthetic drying oil (polymer) and method of making same.

2,627,498 (Shell Development Co.) Process for oxidizing asphalt in presence of Friedel-Crafts catalyst.

2,627,508 (California Research Corp.) Long oil alkyd resins.

2,627,938 (Research Products Corp.) Method of making thixotropic high viscosity products having petroleum oil base for cosmetic and air filter use.

2,628,187 (Research Products Corp.) Medicinal mineral oil vehicle thickened with polyethylene.

2,628,205 (Research Products Corp.) Viscous hydrophilic composition (oil-polyethylene) and method of making the same.

2,628,891 (Godfrey L. Cabot, Inc.) Apparatus for producing impingement carbon black.

2,629,649 (Shell Development Co.) Amine salt vapor-phase corrosion inhibitor.

2,629,666 (Standard Oil Development Co.) Rust preventative composition (asphalt thickened to grease-like consistency).

2,629,676 (Lubrizol Corp.) Corrosion inhibitors (organometallic phosphide).

2,629,697 (Wyandotte Chemicals Corp.) Alkyl aryl sulfonate-liquid hydrocarbon-aliphatic hydroxy compound compositions, containing kerosene distillate.

Miscellaneous

2,627,745 (California Research Corp.) Flash point apparatus.

2,628,112 (Phillips Petroleum Co.) Self-aligned lubricating stuffing box.

EQUIPMENT

Processing, general

2,627,396 (Edward Simons) Induced draft cooling tower.

2,627,397 (Phillips Petroleum Co.) Bubble cap assembly for fractionating tower.

2,627,455 (Union Oil Co. of Calif.) Apparatus for coal gasification by reaction at elevated temperatures with oxygen and steam.

Patents

2,627,497 (Phillips Petroleum Co.) Pebble heater apparatus and method for heat exchange.
2,628,674 (United Carbon Co. Inc.) Gas injector for distributing hydrocarbon gases within a carbon black converter.
2,629,654 (Shell Development Co.) Horizontal cylindrical vessel and method for contacting two counter-flowing and at least partially immiscible fluids.

Catalytic Reactors

2,627,522 (Standard Oil Development Co.) Reactor and method for synthesizing hydrocarbons from carbon monoxide and hydrogen by means of exothermic catalytic reaction.
2,628,158 (Sinclair Refining Company) Catalyst stripping vessel.
2,629,653 (Standard Oil Development Co.) Catalyst stripping section, for the reactor section of a fluid catalytic cracking unit.
2,629,684 (Universal Oil Products Co.) Fluid catalytic cracking apparatus and method for operating on a liquid charge.

Instruments

2,627,183 (General Precision Laboratory Inc.) Differential pressure translator.
2,627,249 (M & J Engineering Co.) Fluid pressure operated positioning apparatus for motor valves.
2,627,250 (Rockwell Mfg. Co.) Piston type fluid flow displacement meter.
2,627,281 (Moore Products Co.) Flow controller.
2,627,453 (The Milton Roy Co.) Automatic titration system.
2,627,543 (The Illinois Testing Laboratories Inc.) Ionization type gas flowmeter.
2,627,745 (California Research Corp.) Flash point operator.
2,627,749 (Research Corp.) Diaphragm type pressure indicator.
2,627,750 (The Bristol Co.) Differential pressure indicating device.
2,627,870 (Grove Regulator Co.) Fluid flow control valve and pressure reducer.
2,627,876 (The Daniel and Florence Guggenheim Foundation) Venturi control for liquid flow.
2,628,149 (The Bristol Co.) Multiple-point recorder.
2,628,454 (The Mueller Co.) Fluid pressure regulator.
2,628,509 (Standard Oil Development Co.) Liquid level indicator for process vessels.
2,628,606 (Research Corp.) Automatic control system.
2,629,053 (Phillips Petroleum Co.) Detonation meter calibrator.
2,629,055 (Consolidated Engineering Corp.) Mass spectrometer.
2,629,089 (The Texas Co.) Feed indicator for liquid pumps.
2,629,261 (Alfred H. McKinney) Apparatus for measuring the level of fluent material in a tank.
2,629,262 (Ernest F. Vilter) Liquid level sight gauge glass.
2,629,826 (Alco Valve Co.) Electronic controller for liquid level.
2,629,827 (Eckert-Mauchly Computer Corp.) Memory system for electronic computers.

Pumps & Compressors

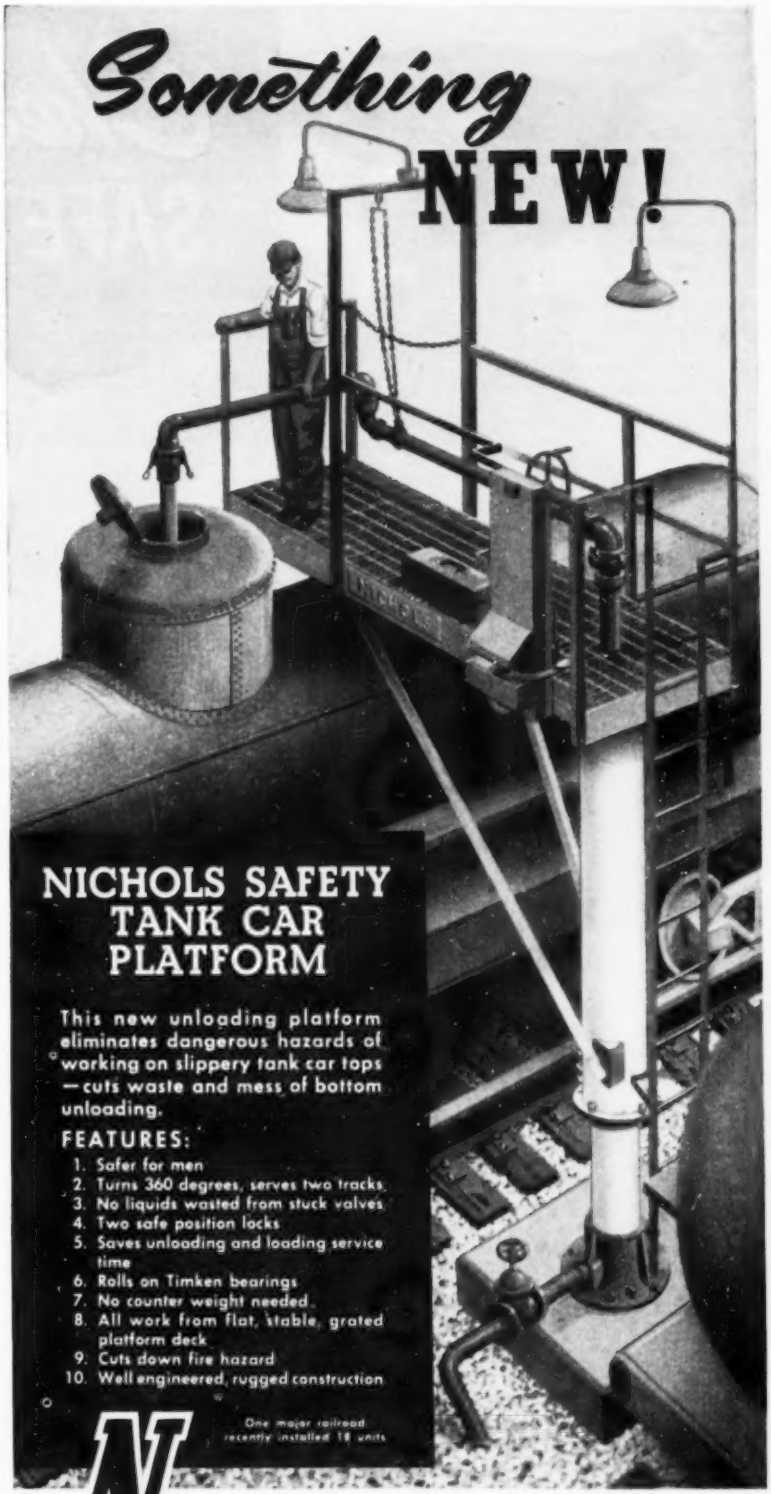
2,627,813 (De Laval Separator Co.) Proportional pumping unit of positive displacement type.
2,627,817 (Goulds Pumps, Inc.) Self-priming centrifugal pump.
2,628,568 (Ellipse Corp.) High-pressure pump of the rotary positive displacement type.

Valves & Fittings

2,628,058 (Hays Mfg. Co.) Tamper-proof plug valve.
2,628,059 (Tri-Clover Machine Co.) Lift plug valve.
2,628,060 (The Parker Appliance Co.) Rotary plug valve seat.
2,628,632 (Manning, Maxwell & Moore, Inc.) Safety valve for high pressure saturated vapors.
2,628,633 (American Car & Foundry Co.) Safety valve.
2,629,448 (Union Carbide & Carbon Corp.) Liquid proportioner for use in a chemical solution fire-fighting system.
2,629,553 (Adolf Karel Velan) Universal steam trap.
2,629,578 and 2,629,579 (The Paul Valve Corp.) Ball valve.

Miscellaneous

2,627,361 (A. O. Smith Corp.) Pressure vessel closure seal.
2,628,159 (Fisher Scientific Co.) Liquid gas contact apparatus for the laboratory.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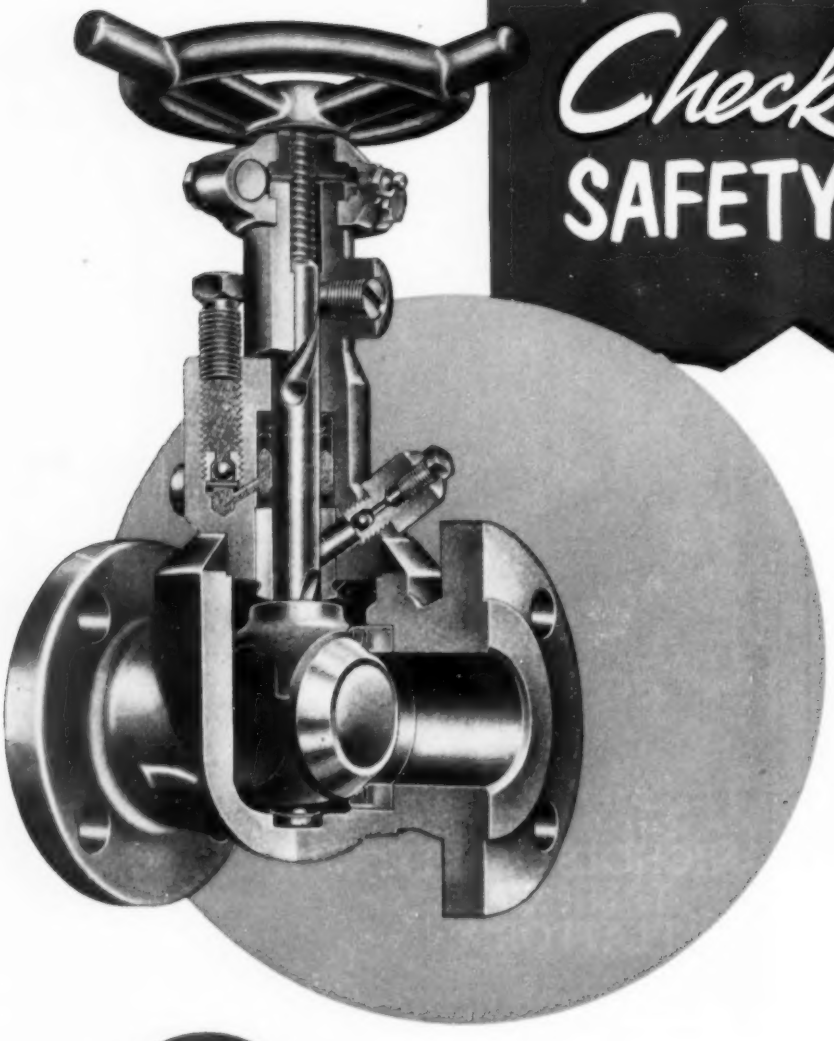
NICHOLS SAFETY TANK CAR PLATFORM
This new unloading platform eliminates dangerous hazards of working on slippery tank car tops—cuts waste and mess of bottom unloading.
FEATURES:
1. Safer for men
2. Turns 360 degrees, serves two tracks
3. No liquids wasted from stuck valves
4. Two safe position locks
5. Saves unloading and loading service time
6. Rolls on Timken bearings
7. No counter weight needed
8. All work from flat, stable, grated platform deck
9. Cuts down fire hazard
10. Well engineered, rugged construction
One major railroad recently installed 18 units
NICHOLS ENGINEERING CO.
3816 W. GRAND AVE., CHICAGO 51, ILLINOIS
SERVING RAILROADS SINCE 1894

(To obtain more data on advertised products see page 600)

Check the SAFETY ZONE



Yes . . . check the safety zone before ordering valves. Check . . . for voids in the body that could retain fluid when the valve is closed or open.

ORBIT VALVES ®

ORBIT Forged Steel LP GAS VALVES are designed so that there are no voids in the body of the Valve, for fluids to become trapped that could feed a fire or contaminate a different product. When the valve is closed it drains clean.

Your Supply Store carries ORBIT Forged Steel Valves in stock. Sizes 1" to 4". ASA Ratings 150 lb. Class to and including ASA 2500 lb. Class. Screwed and Flanged Ends. Maximum Rated Working Temperature 250° Fahrenheit.

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(Serving the Rocky Mountain States and Canada)

ORBIT VALVE COMPANY

P. O. BOX 699 **TULSA, OKLA.**

PERSONALS

Alan T. Knight has been elected to the newly-created position of executive vice president of Catalytic Construction Co., Philadelphia, and **Wilbur E. Kelley** has been named vice president in charge of engineering.

Mr. Knight

Mr. Kelley

Mr. Knight has been vice president of the company since 1946, specializing in labor relations. Prior to joining Catalytic Construction, he was manager of construction and maintenance of Sun Oil Co.'s refinery at Marcus Hook, Pa. He is a graduate of Drexel Institute of Technology, and is a civil engineer and registered professional engineer in Pennsylvania.

Mr. Kelley in his new position will direct all engineering phases of the company's activities in the oil refining, chemical and petrochemical fields in the U. S. and Canada, including process designing and drafting, as well as engineering. Before joining Catalytic, Mr. Kelley was manager of the New York Operations Office of the U. S. Atomic Energy Commission.

He attended Speed Scientific School of the U. of Louisville, receiving B.S. and C.E. degrees and Doctor of Engineering, honoris causa.

* * *

George E. Temple is now vice president and general manager of Catalytic Construction of Canada, Ltd., succeeding Gordon R. Henderson, who resigned to become manager of Sun Oil's new refinery at Sarnia. His headquarters will be in that city.

For 16 years prior to joining Catalytic, Mr. Temple was associated with Anglo-Iranian Oil Co., Ltd. He attended Rutherford, Sunderland and Middlesborough Technical Colleges, in England, and Harvard University. He is a member of the Institute of Petroleum, The British Institute of Management, and an associate of the Institution of Mechanical Engineers, of Great Britain.

* * *

F. B. Hilmer has been appointed department head, market development, of Shell Development Co.'s Emeryville research center, Emeryville, Calif. Mr. Hilmer joined Shell Development in 1934 after receiving AB and MA degrees in chemistry from Stanford U. He went to New York in 1945 as a technical representative, returned to Emeryville in 1951 as assistant department head of market development.

* * *

William N. Holt has been named manager of foreign operations, Eastern Hemisphere, of The Texas Co. He was formerly managing director of Caltex (Ireland) Ltd., an affiliate of Regent Oil Co., Ltd., a British company jointly owned by California Texas Oil Co. Ltd. and Trinidad Leaseholds Ltd. He was educated at the U. of Wisconsin. In 1937 he joined The Texas Co., from there going to join Caltex in 1947.

* * *

Seven men have been advanced to positions of assistant superintendents in petrochemical production departments at the Freeport, Texas, plant of Dow Chemical Co. They are: **John T. Barton** and **F. Whitson** at the ethylene glycol plant; **Don Rikard, Guy H. Watkins** and **E. H. Ivey, Jr.** in the light hydrocarbon unit; **Walter M. Hoffman** at perchlorethylene, and **J. T. Brawner** at the vinyl and vinylidine chloride ("V1-V2") department.

Mr. Barton joined Dow in 1950 as a student trainee and later was made research and development engineer. Mr. Whitson's service with Dow began in 1942, but his job as a chemist in the glycol department was interrupted by World War II. Mr. Rikard also started as a student trainee and was promoted from his former job as a research and development engineer.

Mr. Watkins started in 1950 as a production development engineer in light hydrocarbons before his promotion. Mr. Ivey started with Dow as a research and development engineer in 1950, following a wartime hitch and service with Houdry Process Corp.

Mr. Hoffman started with Dow in 1950 as a student trainee and subsequently became a research and development engineer in perchlorethylene. Mr. Brawner came with Dow in 1941 as an operator in the glycol department, then served four years in the Navy and completed his college work before returning in 1949 as a research and development engineer in the V1-V2 department.

* * *

William C. Bryant has joined Magie Brothers, Chicago, as research director. He will have charge of all products development on lubricating greases, process oils, cutting oils and core oils. At present he is dividing his time between Magie's Chicago and Franklin Park plants, although the company plans to consolidate all research facilities in one new laboratory at Franklin Park this spring.

Mr. Bryant

* * *

E. E. Lyder and **Nathan Shlechter** have become associated with Bechtel Corp.'s Industrial Division at Los Angeles.

Dr. Lyder, until he retired recently, was general manager of the El Segundo refinery of Standard Oil Co. of California. He will be a Bechtel consultant on refinery and petro-

WITH 100 U. S. PATENTS APIECE to their credit, three research chemists of Standard Oil Development Co. have been awarded engraved gold watches. Shown above (L to R) are: **Dr. Louis A. Mikeska,** whose patents are in the field of lubricating oil additives; **Dr. William J. Sparks,** director of the company's chemical division and co-inventor of Butyl rubber; **Willard C. Asbury,** SOD vice president, who presented the awards; and **David W. Young,** whose patents cover antioxidants and new uses for polymers and resins.

chemical plant engineering and operation.

Dr. Shlechter joins the Bechtel engineering staff as a process design engineer in the fields of petroleum refining and petrochemistry.

* * *

Thomas C. Keeling, Jr. has been appointed president of Mathieson Hydrocarbon Chemicals Division of Mathieson Chemical Corp., his headquarters to be in Baltimore. He will be responsible for domestic and Canadian sales of all organic chemicals and for the operation of Mathieson's plants at Doe Run, Ky.; Morgantown, W. Va., and Niagara Falls, N. Y. He was formerly assistant vice president and sales engineer of the chemical division of Koppers Co. and served as a director of the chemical division, National Production Authority, from Sept. 1952 to March 1953. He graduated from MIT in 1935, with a BS degree in Chemical Engineering and Business Administration.

Mr. Keeling

* * *

K. E. Marple has been appointed manager of the Denver laboratory of Shell Development Co's Agricultural Research Division. He joined the company in 1935, after receiving his doctorate in chemistry at Iowa State College. He was formerly an acting department head at Shell's Emeryville (Cal.) Research Center, and was transferred to Denver in 1952.

* * *

W. H. Tonn, Jr. is now associated with the John J. Harte Co., Houston, in a consulting capacity on all phases of chemical development and research. He received his BS and MS in chemical engineering, and his PhD, from the U. of Texas. He has served as research technologist, Shell Chemical Co.; senior chemical engineer, Sinclair Rubber, Inc.; and chief engineer, Rohm and Haas Co., all in Houston.

* * *

Norman W. McCrae became superintendent of Imperial Oil's Halifax, N. S. refinery upon the recent retirement of **R. D. King.** He was transferred from the Sarnia, Ont., refinery, where he had served in various capacities for 30 years, becoming its superintendent in 1947. He also assisted with the organization of St. Clair Processing Corp. in 1942, and was its first process superintendent.

G. R. McMillin succeeds Mr. McCrae as superintendent at Sarnia, being promoted from assistant superintendent. A native of Barrie and a graduate chemical engineer of the U. of Toronto, he joined the Imperial company in 1933. In 1938 he was loaned, for a short term, to International Petroleum at Talara, Peru.

Mr. King, who retired as superintendent of the Imperial refinery at Halifax, joined its staff in 1917, when the refinery was still under construction. He has been with the company since 1915.

* * *

Leon G. Dufilho has been appointed manager of refineries at Eastern States Petroleum Co., Houston. He has been associated with the oil industry since receiving his degree in engineering from Vanderbilt U. in 1923. He began his career as an engineer with Louisiana Oil Refining Corp., Shreveport, La., and for two years was chief engineer for Lion Oil Co. at El Dorado, Ark. For the past 19 years he has been with Premier Oil Co., Longview, Texas. Prior to coming with Eastern States he was director of refineries for Premier for two years.

Mr. Dufilho

* * *

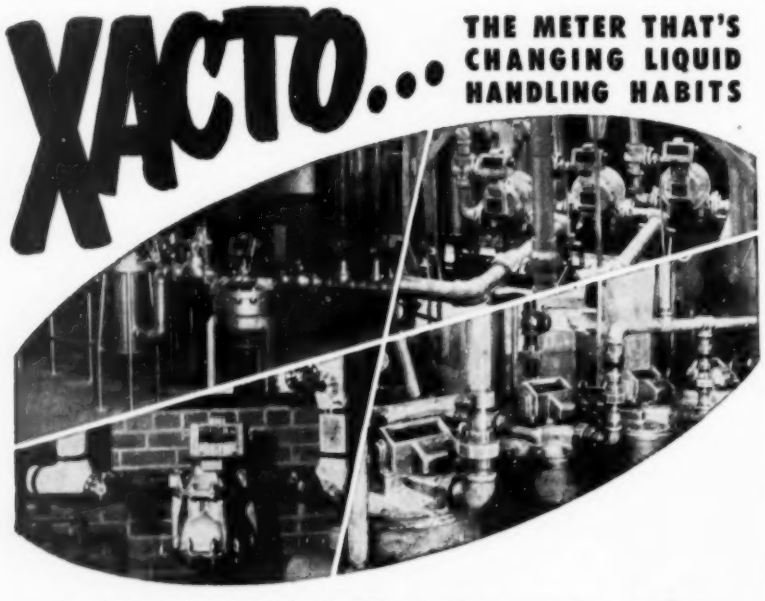
Samuel A. McKee has retired as chief of the Lubrications Section of the National Bureau of Standards, after 32 years of service. He was responsible for basic and applied research in engines and lubrication, including testing of lubricants and liquid fuels, research on viscosity and maintenance of viscosity standards. Born in Buffalo, he received a BS in mechanical engineering at Rhode Island State College.

* * *

James N. Garrison is now projects engineer of the Petroleum Refinery Division of Arthur G. McKee & Co., Cleveland. He was formerly chief engineer of this division. **James C. Baird** succeeds Mr. Garrison as chief engineer, having been promoted from assistant chief engineer.

* * *

V. R. Smith has been named technical assistant to the manager in the petroleum products research section



In petroleum processing plants XACTO meters have proved the most effective way to measure liquids . . . accurately and dependably. XACTO safely handles 662 different liquids in processing, blending, packaging and many other operations . . . in batching or continuous operation.

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(To obtain more data on advertised products see page 600)

of development and technical service divisions at the Richmond laboratories of California Research Corp. **J. E. Hanson** has been made division supervisor, fuel oils, asphalts and special products.

* * *

Dan Lewis, Jr., formerly a development and control chemist with Shell Chemical Corp. and California Research Corp., is now in the chemical division of Goodyear Tire & Rubber Co. He has been assigned as a special representative in the division's Dallas office, to provide service and technical information on chemical products in Arkansas, Louisiana, Oklahoma and Texas.

* * *

David F. Edwards, formerly assistant head of the petroleum products division at the Baton Rouge, La. refinery of Esso Standard Oil, has been appointed assistant general superintendent of the Bayonne, N. J. refinery, succeeding W. F. Wadt, who recently became general superintendent. A native of Mississippi, Dr. Edwards received his BS degree from Louisiana State U. and his doctorate from the U. of Pittsburgh. He joined Standard Oil Co. (NJ) in 1926.

Dr. Edwards

D. O. Swan, formerly superintendent of the refining and oil movement department, succeeds Dr. Edwards as assistant head of the petroleum products division at Baton Rouge.

* * *

J. Kenneth Craver is now manager of government business development, a newly-created post in the development department of Monsanto Chemical Co.'s Organic Chemicals Division. He has been with Monsanto since 1938 and has specialized in synthetic lubricants and hydraulic fluids. He received his MS in chemistry from Syracuse U. in 1938.

* * *

Earle Gard, vice president of Ralph M. Parsons Co., Los Angeles, and former director of research, Union Oil of California, will be in charge of construction of an $8 million refinery to be built for the Turkish government at Batman, Turkey.

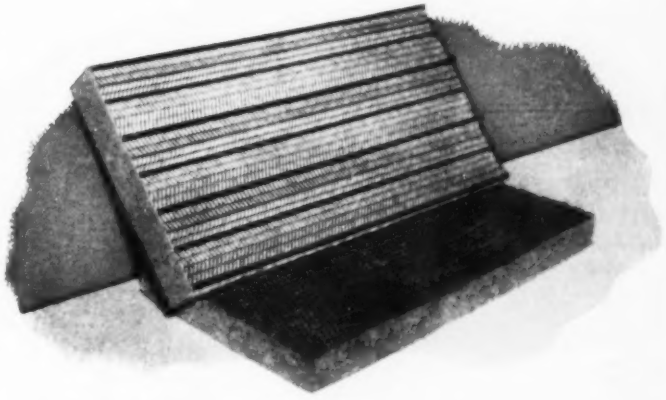
* * *

Thomas L. Taggart, manager of Standard of California's natural gasoline department since 1942, died in San Francisco on Jan. 23 following a week's illness.

Mr. Taggart joined Standard in 1927, served 10 years as contract superintendent for Standard Gasoline

Copr-fibre

LAMINATED
Long-fibre BLANKETS

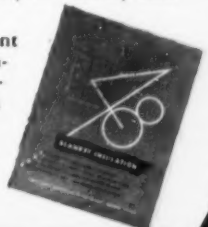


Vastly Improve Insulation
APPLICATION . . . EFFICIENCY . . .
PERFORMANCE!

Here's Why: Copr-fibre Blankets are made by laminating long, mineral wool fibres together to form a tough, resilient blanket *before wire mesh is attached.*

As a result this exclusive Copr-fibre two-stage manufacture gives you these advantages:

- **FASTER APPLICATION,** because laminated blankets cannot loosen or fall apart under the abuse of handling. And because Copr-fibre blankets come in convenient large sizes, are light in weight, clean, shot-free.
- **MORE INSULATING EFFICIENCY,** because laminated, longer fibres guarantee lower thermal conductivity. Two-stage manufacture is your insurance of uniformity of density and of consistency in all dimensions.
- **BETTER PERFORMANCE,** because resilient long-fibre Copr-fibre blankets maintain integrity, both of insulation and weatherproofing, throughout expansion and contraction cycles of heated and cooled equipment.



SEND FOR THIS BULLETIN. Copr-fibre Bulletin 511 gives you all the facts on what we believe is the only *modern* blanket insulation. Your copy will be sent free upon request. Write today.

Telephone: Aurora 9207

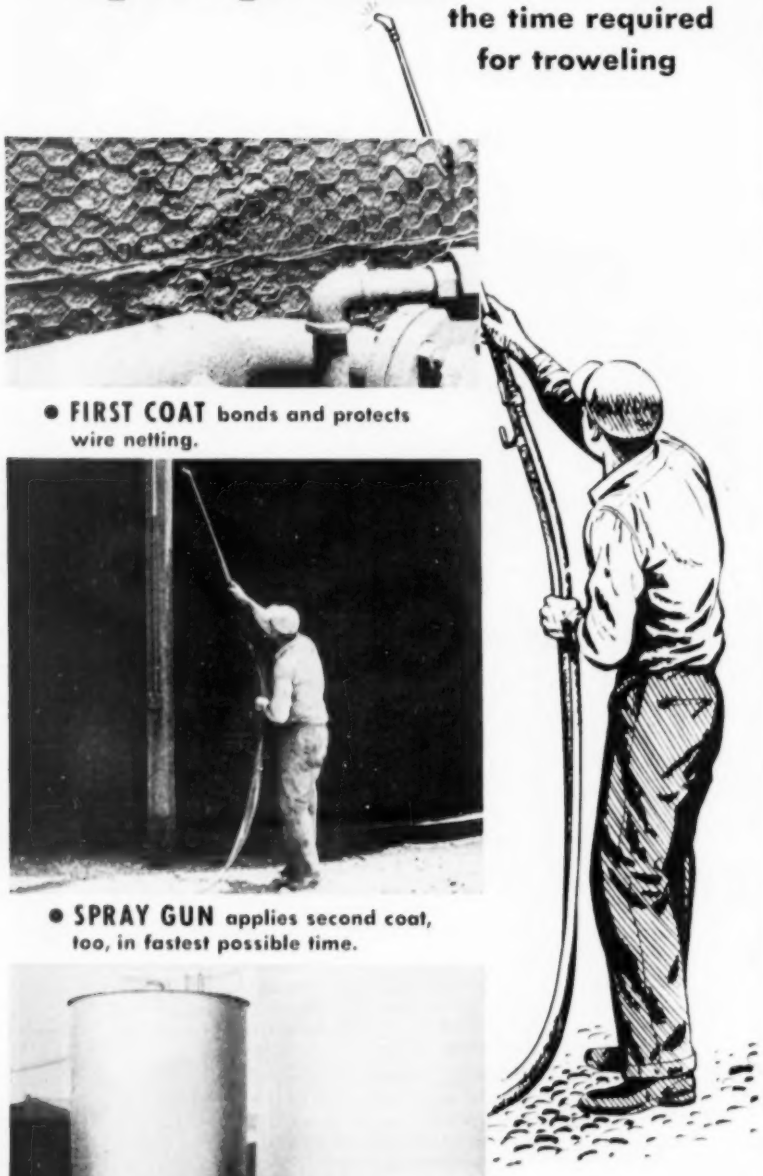
(To obtain more data on advertised products see page 600)

Now — fast insulation protection

Laykold® WEATHERCOAT

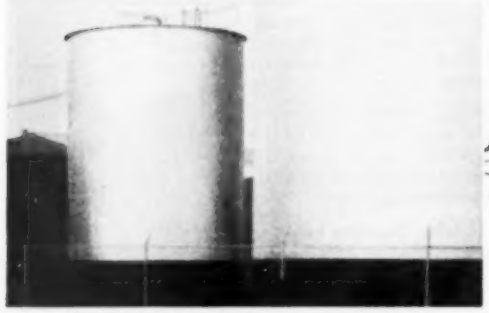
ASPHALT SPECIALTIES

sprays on! —in one-third the time required for troweling



• **FIRST COAT** bonds and protects wire netting.

• **SPRAY GUN** applies second coat, too, in fastest possible time.



• **TRIPLE-SEALED** and smooth, after wet brooming.

WEATHERCOAT—the standard of quality in the industry —for lasting protection.

AMERICAN Bitumuls & Asphalt COMPANY

200 BUSH STREET
SAN FRANCISCO 4, CALIF.

Personals

Co., a subsidiary, and in a similar capacity for Standard's natural gasoline department until 1942.

• • •

Wayne E. Kuhn, Manager of the Technical and Research Division of The Texas Co., New York, a pioneer in development work in petrochemicals, becomes the new president of the Commercial Chemical Development Assn. on July 1.

Dr. Kuhn

He studied in Reed College, Portland, Ore., and secured his PhD from Cornell U. in 1929 and started to work for The Texas Co. as a chemist. He was for a time in Port Arthur and came to New York in 1937 as assistant to the Director of Research. In 1938 he became Manager of the Technical and Research Division.

• • •

Richard L. Sawyer has been promoted to supervisor, Fuels Development Research Dept., at Texaco's Beacon, N. Y. laboratories. He has been with The Texas Co. since 1938. He has a BS in chemical engineering and an MS in chemistry from George Washington U., and a PhD in organic chemistry from Cornell.

• • •

Kenneth E. Dyer has been advanced to the post of manager of refining for Husky Oil Co. He was previously superintendent of refining, and has been with Husky since the firm was originally incorporated in Wyoming in 1938.

• • •

Eugene Holman, president of Standard Oil Co. (N. J.) has been appointed by President Eisenhower as one of seven consultants to National Security Council, top U. S. strategic planning body. The consultants are to serve for a short time in an advisory capacity to NSC on general problems relating to its policies and programs.

• • •

T. Wayne Warren has joined Ethyl Corp. as supervisor in refinery technology at its Detroit research labs. Prior to joining Ethyl, he was on leave of absence from Humble Oil & Refining's technical service division, serving as an aviation fuels specialist for PAD in Washington. He is a graduate of the U. of Texas.

Mr. Warren

PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY APRIL 1953

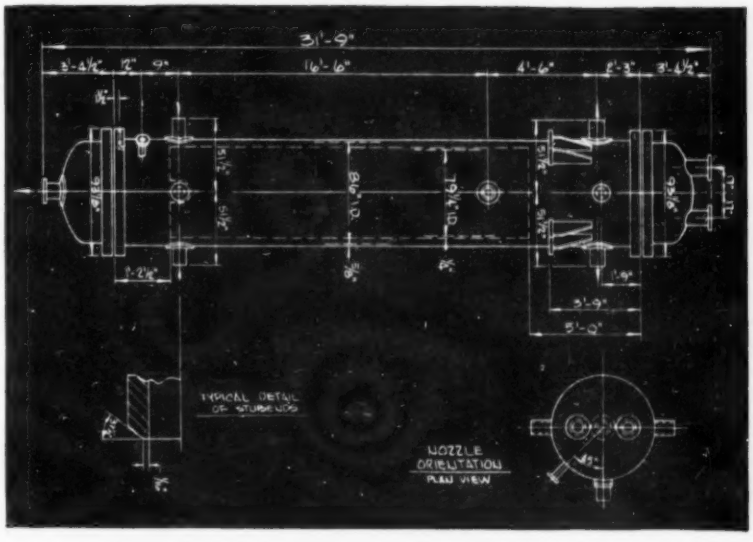
Special Pre-Heater Monel-Protected Against Caustic

One unusual feature of a special exchanger now in the shops lies in the extensive use of corrosion-resistant Monel® for all parts which might come in contact with caustic soda.

To be installed as a caustic preheater in an eastern seaboard refinery, the unit will have Monel tubes and Monel-*clad* tube sheets. Furthermore, the interior of the channels is protected by a cladding of Monel, while the heads are fabricated from castings of the same high-nickel alloy.

When in service, the exchanger will have 150-pound steam on the shell side which will raise the temperature of the caustic from 155° to 245°F. Twenty inches in diameter, the unit has 16-foot tubes of one-inch by 14-gage Monel. Cladding on the tube sheets is 15% of the overall thickness of the sheet.

® Trademark of the International Nickel Company, Inc.



High Pressure Units for Sumatran Cracker

Six intercondensers for a renovated thermal cracker in Sumatra have just been designed by Kellogg's Fabricated Products Division. Made of alloy steel, they will operate at 1300 psi and 800°F, condensing tower overhead and preheating feed stock. Each condenser will measure 20-feet in length by four-feet in diameter, the shells being 1⅛ inches thick.

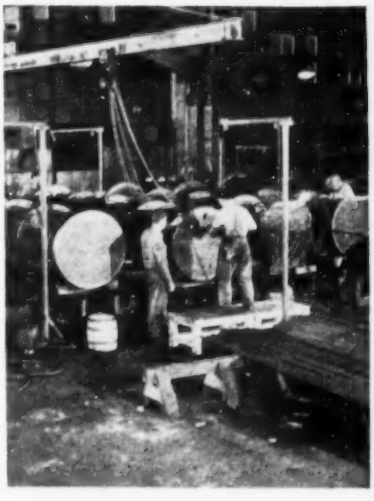
For further information, details of methods, etc. contact
FABRICATED PRODUCTS DIVISION
THE
M. W. KELLOGG
COMPANY
225 Broadway, New York 7, N. Y.
Offices in Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London & Paris
KELLOGG PULLMAN

Synthetic Fibre Producer Gets Unusual Converters

Most heat transfer devices are designed so that tube bundles can be pulled at regular intervals for cleaning. However, Kellogg has just designed and is now fabricating a set of three synthetic fibre converters which have fixed internals. Special processing conditions, under which materials to be put through the shell side are previously treated, prevents fouling of these sections of the converters. Specification of Stainless Type 340 tubes removes any danger of corrosion in the tube stream and also meets requirements of rather severe operating conditions—650°F and 250 psig. Largest of the three units will measure 23 feet long by 7 feet in diameter and weigh some 23 tons.

Exchange Equipment by the Carload for Midwestern Refiner

Exchangers . . . condensers . . . coolers . . . reboilers by the score are in the design and fabrication stages at Kellogg for two locations operated by the same mid-western refiner. Including a multiplicity of varied sizes—ranging from 13 inch-124 sq.ft. debutanizer reboilers to 39 inch-13,000 sq.ft. fractionator overhead condensers—the order includes both equipment for new processing units as well as replacement bundles for existing equipment which is being modernized. This job demonstrates the flexibility of Kellogg fabricating facilities in which orders for one cooler or a hundred AEC exchangers are processed to the highest quality standards.



Barrel Octanes from Houdriforming

WHEN YOU DECIDE ON HOUDRIFORMING
YOU KNOW WHAT YOUR YIELDS WILL BE

they're guaranteed

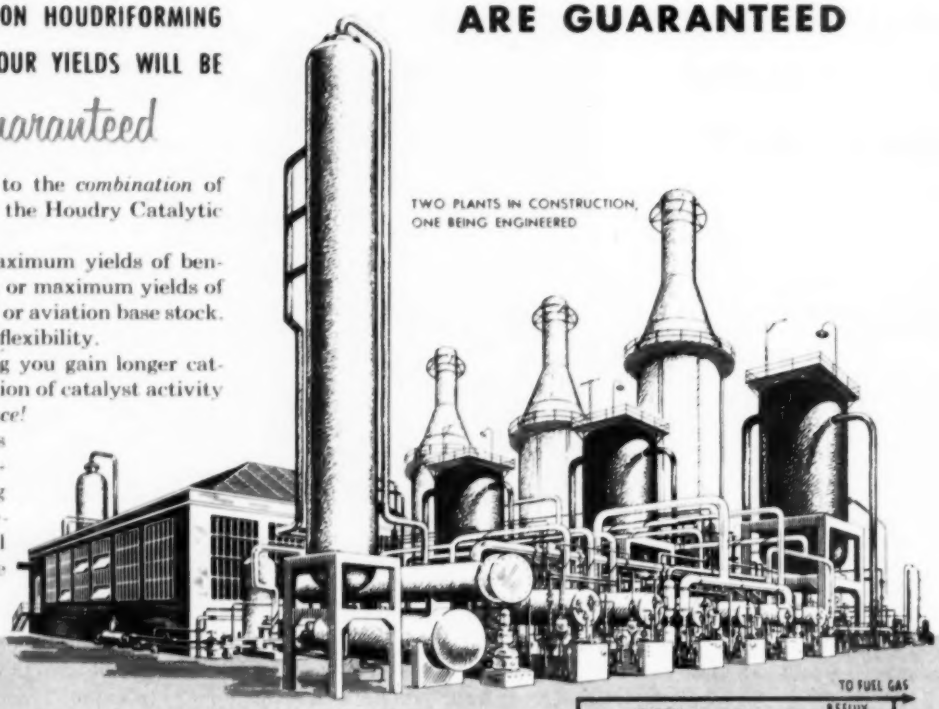
ARE GUARANTEED

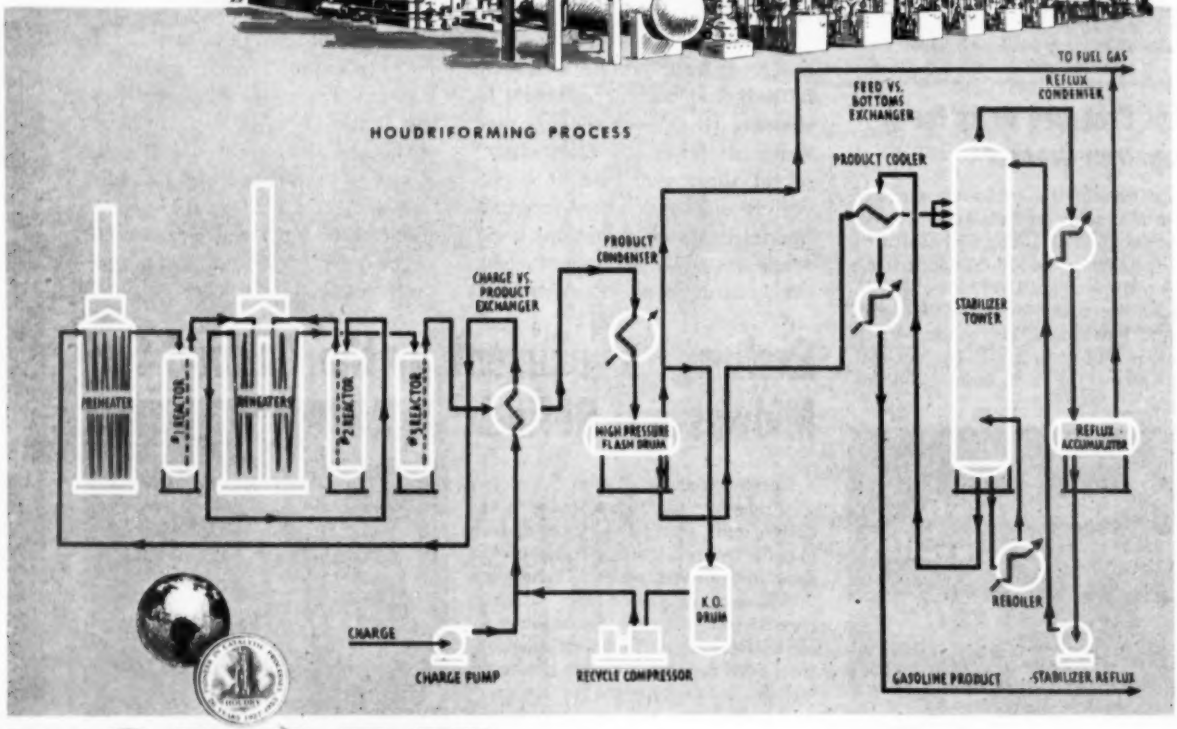
● There is no equal to the *combination* of advantages offered by the Houdry Catalytic Reforming Process.

You are assured maximum yields of benzene, toluene, xylenes; or maximum yields of high octane motor fuel or aviation base stock. Either with complete flexibility.

With Houdriforming you gain longer catalyst life, plus restoration of catalyst activity by regeneration *in place!*

Whether your plans for expansion or renewal of plant processing facilities are immediate or future, it will pay you to investigate Houdriforming.





HOUDRY

PROCESS CORPORATION

1528 WALNUT STREET, PHILADELPHIA 2, PA.

International Licensors: World Commerce Corporation, S.A.

PIONEER in CATALYTIC PROCESSES

(To obtain more data on advertised products see page 600)

Inaugurate Plastics Course

Atlas Mineral Products Co. has established instruction courses on plastic materials used in construction, to begin this summer. Previously, these courses had been given impromptu to visiting corrosion engineers from larger chemical and steel companies. Now all interested corrosion engineers or maintenance men are invited regardless of company affiliation.

Corrosion engineers will attend a full week course while maintenance men enroll for a three day study period.

No tuition is charged, but applicants accepted are expected to defray their own transportation and living costs. Attendance is limited to male industrial engineers and maintenance personnel requiring a knowledge of corrosion resistant coatings, linings, jointing materials, fabricated plastics and caulking materials.

Those wishing to attend should make application at least three weeks in advance. Applicants should list three different weeks, stating order of preference.

Subjects covered include basic fundamentals of plant design, properties of plastics and ceramic materials used for chemical resistant equipment, protective coatings, rubber and plastic linings, chemical resistant cements and many other phases of corrosion resistant construction.

Applicants should write to Joseph A. Snook, vice president, Atlas Mineral Products Co., Mertztown, Pa., for complete information.

A-C Organizes Rockies Region

Allis-Chalmers Mfg. Co. has combined its district and branch office territories of Denver, Salt Lake City, Phoenix, El Paso and Spokane into the Rocky Mountain region with headquarters at Denver.

Manager of the new region is Richard D. Moody, in charge of the Los Angeles district office since 1950. Graduate of Colorado School of Mines, Moody first joined Allis-Chalmers in 1938. He is associated with several mining and electrical organizations being vice president of the Pacific Coast Electrical Association.

Successor to Moody as manager of the Los Angeles district office is Richard L. Engel.

Giant Test Tube Checks Mixers

Mixing Equipment Co., Inc., Rochester, N. Y., recently erected a 20 x 30 ft., 70,000 gallon test tank said to give accurate data on blending of fluids in big tanks.

Quantitative studies on blending operations in the giant "test tube" provide information on single and multiple installations of side entering mixers, location of multiple units and angle of entrance of mixers. Comparisons between mechanical mixers, air agitation and liquid jets can be made.

Power measurements on side entering impellers can be taken, with accurate instrumentation, on multiple mixer installations totaling up to 100 hp., and on single mixers up to 50 hp.

The tank is Mixing Equipment's newest addition to its research development laboratory.

Ansul Opens Southwest Branches

Ansul Chemical Co., Marinette, Wis., producer of dry chemical fire extinguishing equipment, is opening new branch offices in the Houston, Dallas-Fort Worth and Tulsa areas.

Supervising Southwest district sales for the firm will be C. H. Armstrong. Virgil Murry will manage the Houston office at 1110 White St., Neal Engberg will manage the Dallas-Fort Worth office at 907½ Throckmorton St., Fort Worth, and Roger Allen is to manage the Tulsa office.

NCA Gives Eight Safety Awards

Awards for outstanding safety records during 1952 have gone to eight member firms of the National Constructors Association, composed of engineering and construction companies specializing in design and construction of chemical plants, steel mills and oil refineries.

Winners are Bechtel Corp., San Francisco; H. K. Ferguson Co., Cleveland; Fluor Corp. Ltd., Los Angeles; Lummus Co., New York City; Arthur G. McKee & Co., Cleveland; Rust Engineering Co., Pittsburgh; Procon Inc., Chicago; and Stone & Webster Engineering Corp., Badger Process Division, Boston.

The awards are part of a continuing year-round "safety engineering" program launched by NCA to reduce severity and frequency of accidents in the construction industry.

C-H Completes Expansion

Launched in 1946, the building expansion program of Crouse-Hinds Co., Syracuse, N. Y., is slated for completion this year.

By next fall, when a new 45,000 square foot foundry now under construction is completed, Crouse-Hinds will have added 180,000 square feet to its plant facilities.

The firm manufactures industrial electrical equipment.

Miller Co. Buys Bonney Forge

Miller Mfg. Co., Detroit, has purchased Bonney Forge & Tool Works, Allentown, Pa., according to an announcement by Miller president Joseph W. McDougal.

Miller produces special service tools for the automotive industry, while its new subsidiary, Bonney Forge, is a well-known manufacturer of mechanic's hand tools.

Under Miller ownership, Bonney management will be directed by Joseph W. McDougal. Arthur J. Male, former president, will be chair-

This spacious, three-storied research laboratory is to be constructed by Allied Chemical & Dye Corp.'s General Chemical Division at Morristown, N. J. The building will have 50,000 square feet of floor space and is to be equipped with the latest types of research equipment. Construction of this research center will permit General Chemical to expand its laboratory program and at the same time replace the Division's present facilities at Laurel Hill, Long Island, N. Y.

Double Assurance

WHEN YOU SPECIFY

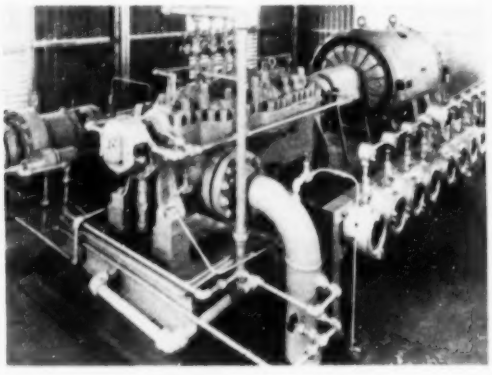
Pacific PRECISION BUILT PUMPS

The requirements for your specific service having been made known by your engineering specifications you will look carefully into the benefits offered by the various bidders. After looking, it's dollars to doughnuts your requisition will specify *"Pumps by Pacific"* because of the greater benefits of Pacific's *double assurance.*

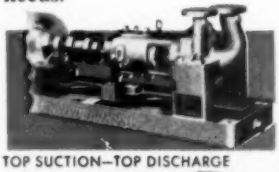
Assurance that Pacific's design, workmanship and materials will fit the requirements of your specific service.

Assurance that Pacific's dependable fast service will fit your needs.

Designs to fit your specific service:



Pacific Pump Operated by Microwave—Unattended

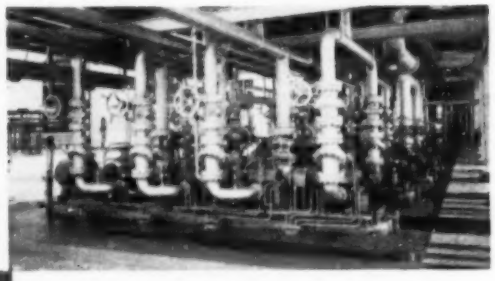


TOP SUCTION—TOP DISCHARGE

END SUCTION—TOP DISCHARGE

END SUCTION—SPECIAL DISCHARGE

Materials to fit your specific service:



Pacific Pumps for Special Service

CAST IRON
ALLOY IRON
BRONZE
CARBON STEEL
ALLOY STEELS including
HIGH NICKEL-CHROME
MOLOY STEELS

PACIFIC *Precision Built* **PUMPS**

Pacific Pumps inc.

ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA

Export Office: Chanin Bldg., 122 E. 42nd St., New York

Offices in All Principal Cities

CP-9

man of the board and Fred S. Durham, Jr., will continue as vice president and secretary.

New Name For Midwest Piping

Midwest Piping & Supply Co., Inc. has changed its name to Midwest Piping Co., Inc., St. Louis.

A. G. Stoughton, Midwest president and board chairman says there has been no change in ownership or activities, but the name change was made by stockholders to more accurately describe the company's operations.

Mr. Clark

Mr. MacKendrick

Mr. Probst

Mr. Laverty

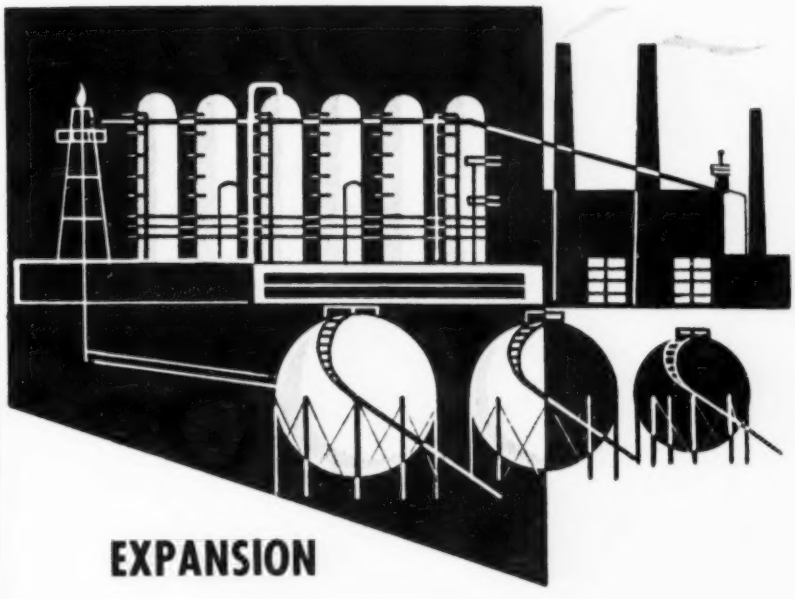
Clark Shifts Board Officers

Board of directors of Clark Bros. Co., Olean, N. Y., has made several important changes in its membership. C. Paul Clark, former president has been named chairman; John N. MacKendrick, formerly vice president in charge of engineering is now president; F. W. Laverty, formerly general sales manager becomes executive vice president; and George W. Probst, formerly western regional sales manager is now vice president in charge of sales.

Mr. Clark has been associated with the organization, founded by his father, for 35 years. After joining the company as chief engineer, he designed a line of engines and compressors for the oil and gas industries.

Mr. MacKendrick came with Clark Co. in 1928 as a design engineer. He is primarily responsible for development of the Clark "Right Angle" "Big Angle" and "Midget Angle" gas engine-driven compressors.

David K. Hutchcraft, former vice president in charge of sales, and



EXPANSION

MODERNIZATION

NEW FACILITIES

KULJIAN OFFERS THESE SERVICES:

STEAM GENERATION & UTILIZATION
ELECTRICAL GENERATION & DISTRIBUTION
FUEL STORAGE SYSTEMS & PIPING
PROCESS SYSTEMS & INSTRUMENTATION
REFINERY FACILITIES IN GENERAL

ENGINEERING—Preliminary studies and designs followed by detailed working drawings and specifications. (Services of resident engineer are optional.)

CONSTRUCTION—Project management, including coordination of sub-contractors and field forces. (Accounting and purchasing services are optional.)

ENGINEERING AND CONSTRUCTION—Undivided responsibility, from preliminary studies to completed construction.

KULJIAN

The Kuljian Corporation

ENGINEERS • CONSTRUCTORS

1200 North Broad Street, Philadelphia 21, Pa.

MEXICO CITY • CARACAS • MADRID • ROME • ATHENS • TOKYO • CALCUTTA

(To obtain more data on advertised products see page 600)

You may be doing just that if your plans don't include CHLORINATION EQUIPMENT for slime control by WALLACE & TIERNAN.

Chlorination equipment because it controls slime that *grows* on the walls of condenser tubes not protected against it. Enough of the growth eventually seriously reduces heat transfer efficiency — actually *insulates* your steam from the cooling water. Back pressures go up, production drops, operating and maintenance costs rise, and eventual shut-down becomes necessary for regular clean-out periods.

Wallace & Tiernan equipment because it is versatile, sturdy and dependable — proven by thousands of successful installations, vouched for by satisfied users everywhere-and because there's a Wallace & Tiernan chlorinator for every job. Write today for information on how Wallace & Tiernan chlorination may help you solve *your* slime problem.

NO WATER IS SLIME-FREE

regardless of the source. Chlorination helps reduce slime in process or cooling water.

CD-37

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

Suppliers

Frederic H. Light, former vice president, secretary and treasurer, have relinquished their vice presidential duties in line with the company's retirement policies, but remain with the firm in an advisory and consulting capacity.

Other important appointments include that of Edward G. Beardsley to vice president, engineering. Richard F. Moser to vice president, manufacturing, and C. C. Hill as secretary and treasurer.

Personnel Changes

American Machine & Metals, Inc.—Duanne R. Lamiman to district sales manager, New York office of United States Gauge Division.

The Louis Allis Co.—Louis Allis, Jr. to vice president from vice president in charge of sales. C. G. Skidmore to vice president in charge of sales from sales manager.

Beckman Instruments, Inc.—Elden D. Haller to eastern sales manager, John D. MacNamara to field sales manager and James T. Luscombe to sales manager of the Synchros division.

Bechtel Corp.—James N. Landis to vice president, R. A. Bowman to manager of engineering for the Power Division, George D. Anderson and Dale Trimell as assistants to John M. Rogers, executive vice president of Bechtel International Corp.

The Bristol Co.—Harry E. Beane to vice president of sales from general sales manager.

Crane Co.—V. P. Rumely to senior vice president, manufacturing, and L. N. Blugerman to vice president, from vice president and executive assistant, respectively.

De Laval Steam Turbine Co.—William J. Healy to sales manager for the blower and compressor division, in addition to his current duties as sales manager of the turbine division.

Dowell, Inc.—L. E. West to general sales engineer and H. B. Green to Houston district sales engineer.

Eggelhof Engineers — Harper M. Young to sales engineer in charge of the Little Rock, Ark. sales office.

Emery Industries, Inc. — J. P. Clancy to the New England sales staff, C. T. Burgess to the southern

sales staff, and E. L. Spencer and E. W. Sack to the sales staff, as yet unassigned.

Koppers Co., Inc.—Carl H. Pottenger to assistant vice president and division sales manager of the company's Chemical Division, and J. W. Pool, Jr. as assistant division sales manager.

Arthur G. McKee & Co.—James N. Garrison to special projects engineer of the petroleum refinery division and James C. Baird to chief engineer of the same division.

Monsanto Chemical Co.—L. William Sessions to St. Louis branch sales office of the Organic Chemicals Division, John K. Lilly to the St. Louis pharmaceutical sales department and David H. Bechtold to the Cleveland branch office.

Orbit Valve Co.—Charles J. Folger to eastern representative and Clyde Chronister to the Gulf Coast division.

H. K. Porter Co., Inc.—Albert B. Diss to vice president and general manager of the Watson-Stillman Co. Division.

Young Radiator Co.—Anthony D. Bogus to assistant sales manager of the industiral and oil field division.

Branches, Distributors

Franklin Pipe & Supply, Ltd. opens a new office and warehouse at 9931 67th Ave., Edmonton, Alberta, Can., in May.

Orbit Valve Co. has a new warehouse at 1740 E. Yellowstone St., Casper, Wyo. Jack H. Hancock, Rocky Mountain field representative is in charge.

Rockwell Mfg. Co. has opened a new office, warehouse and service buiding at 1495 Northside Drive N.W., Atlanta, Ga.

Expansion, Transition

Allen Engineering Co., recently organized firm specializing in chemical process equipment, has its new offices at 15 Alden St., Cranford, N. J.

Magnaflux Corp. has moved to a new plant and general office at 7300 W. Lawrence Ave., Chicago 37, Ill.

New guide to longer life for METAL STRUCTURES

Tells WHAT metal primer to use . . . WHERE and HOW!

The most important part of a metal protective system is the primer. Now it's easy to select the right primers for long-lasting protection of various kinds of metal and conditions encountered in service.

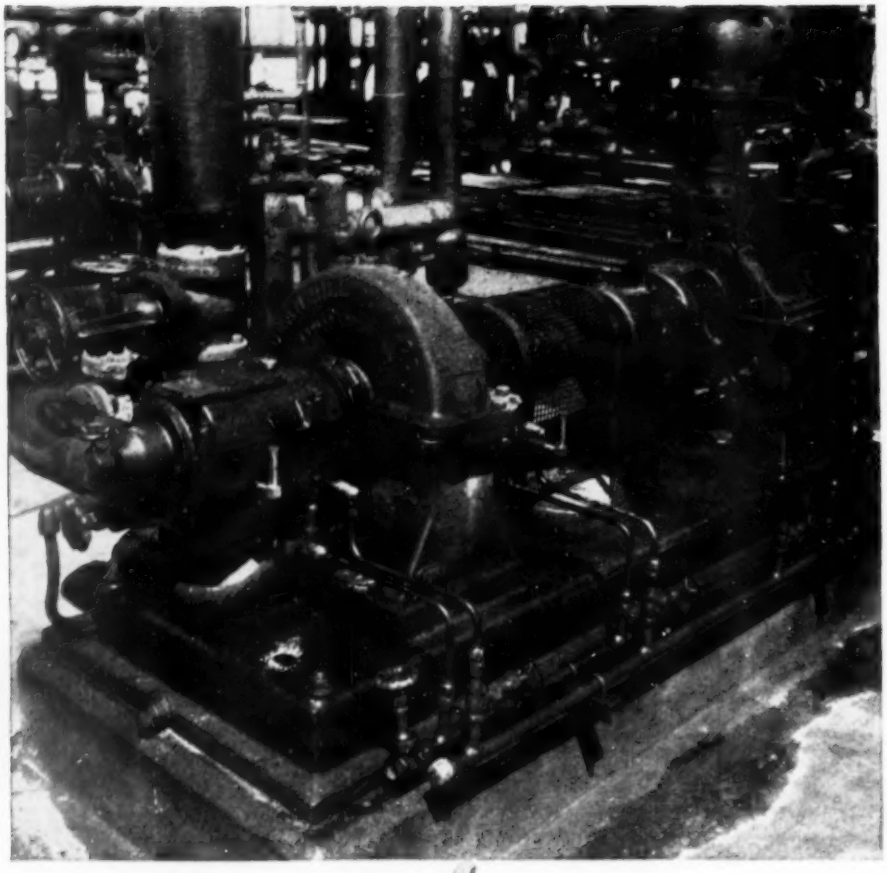
This new 12-page book describes the complete line of Sherwin-Williams Primers . . . tells what primer to use for steel, galvanized iron, galvanneal, terneplate, aluminum. Included are application data and suggestions on proper surface conditioning preparatory to priming.

Be sure you get a copy. Write for Brochure B-769. The Sherwin-Williams Co., Petroleum Division, Cleveland 1, Ohio.

SHERWIN-WILLIAMS

PETROLEUM FINISHES

(To obtain more data on advertised products see page 609)

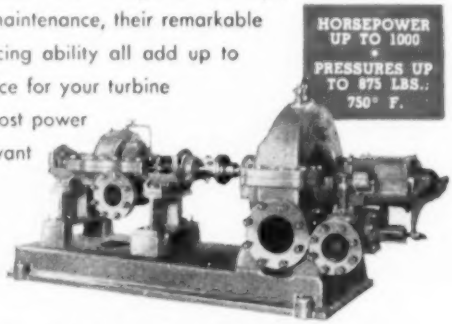


DEAN HILL STEAM TURBINES

are single stage, double impact type for low steam consumption. Specifically designed for operation at medium steam pressures and temperatures, DH Turbines have all the advantages available under these conditions, including excellent water rates. Get the full details and complete specifications. Write today.

POWERFUL "PENNY PINCHER"

Power a-plenty at a penny-pinching cost! That's how DEAN HILL STEAM TURBINES operate. Their super rugged construction, their service-engineered design, their low maintenance, their remarkable power-producing ability all add up to far more service for your turbine dollar. If it's low cost power you want . . . you want DEAN HILL STEAM TURBINES.



DEAN DH HILL PUMP COMPANY

Pump and Turbine Engineers Since 1895

SALES OFFICES IN:

INDIANAPOLIS 7, INDIANA

Chicago • Mexico City • Philadelphia • Salt Lake City • New York • Dallas • New Orleans • San Francisco • Denver • Los Angeles • Pittsburgh • Houston • St. Paul • Cleveland

Technical Forums Will Highlight NGAA Annual Meeting in Houston

CONTINUING the forum-type get-togethers incorporated in last year's annual convention, the Natural Gasoline Association of America has completed plans for its 32nd annual meeting, to be held at the Rice Hotel in Houston, April 29-May 1.

Program chairman Ray A. Carter, Stanolind Oil & Gas Co., Tulsa, says forum sessions are again being used because they "permit separate sessions for different groups of specialists where discussions are confined to their particular field." Particularly attractive to natural gasoline processors will be the forums on laboratory procedure and analysis, increasing yields of ethane and propane, corrosion in natural gasoline operations, liquefied petroleum gas, and plant operations problems.

Entertainment-wise, conventioneers will attend the "25th Anniversary Party" of the Natural Gasoline Supply Men's Association at the Houston Coliseum and Music Hall on Thursday evening, April 30.

Here is the complete convention program:

SPECIAL FORUMS

Wednesday Morning, April 29

Laboratory Procedure and Analysis

"Fractional Analysis Techniques," by S. T. Preston, Oklahoma University.

"An Infrared-Charcoal Absorption Method for Determining Heavy Hydrocarbons in Residue Gas," by C. J. Newton, Magnolia Petroleum Co., Dallas.

"Analysis of Faction," by Lloyd Guild, Burrell Corp., Pittsburgh.

Increasing Yields of Ethane and Propane

"Deep Extraction at Tuscola," by David J. Stark, National Petro-Chemicals Corp., Tuscola, Ill.

"Thermodynamic Data Required for Deep Extraction," by Drs. D. L. Katz and Brymer William, both of the University of Michigan.

"Plant Economics vs. Increasing Cost of Gas," by Harold E. Vaughan, Continental Oil Co., Houston.

Transportation

(Discussions relate particularly to light hydrocarbons)

Corrosion in Natural Gasoline Operations

"Economics of Natural Gasoline Plant Corrosion," by E. W. Wallace, Shell Oil Co., Houston.

"Stress Corrosion Cracking in Water-Amine Gas Treaters," by G. L. Garwood.

Thursday Morning, April 30

Operations

"Approximating the Hydrocarbon Composition of Natural Gas from Absorption Index and Specific Gravity," and "Absorption Index—A Simple Test for Determining an Important Property of Natural Gas," by T. W. Legatski, J. W. Tooke and L. A. Grundy, all of Phillips Petroleum, Bartlesville.

"Charcoal Weight Method for Determining the Propane and Butane Plus Fractions of Natural Gas," by Clare Gard, Union Oil Co. of California, Los Angeles.

Liquefied Petroleum Gas

"Economics of Underground Storage Operations," by Rex Phelps and W. B. Morgan, both of Warren Petroleum Corp., Tulsa.

"Underground Storage—Present and Future," by H. R. Thomas, Stanolind Oil Co., Tulsa.

"LP-Gas and the Gas Utilities," by D. J. Reimers, Minnesota Natural Gas Co., St. Peter, Minnesota.

Statistics on the Natural Gasoline and Cycling Industries

"How To Answer the Mandatory Questionnaires in the 1953 Mineral Industry Survey," by Dr. Maxwell R. Conklin, U. S. Bureau of Census, Washington.

"More Cooperation for Better Statistics," by Donald Colby, U. S. Bureau of Mines, Washington.

GENERAL SESSIONS

Wednesday Afternoon, April 29

Opening of Convention—NGAA president John F. Lynch, La Gloria Corp., Corpus Christi.

Address by J. Howard Marshall, Signal Oil & Gas Co., Los Angeles.

"The CNGA Viewpoint," by Warren H. Kraft, president, California Natural Gasoline Association.

"Economics of Industrial Safety," by Austin F. Allen, Employer's Association and Employee's Casualty Co., Houston.

Presentation of Hanlon Award and Hanlon Award address.

Thursday Afternoon, April 30

"The Communists Within," by Robert Stripling, attorney.

"Can The Refiner Use More Light Ends?" by D. P. Barnard, J. H. Forrester and R. A. Steele, all of Standard Oil Co. of Indiana, Chicago.

"The Jet Story," by R. E. Small, General Electric Co., Cincinnati.

Friday Morning, May 1

"Quiz on Operations"

Legal Aspects—J. T. Lamb, Shell Oil Co., Tulsa.

Sulphur Recovery—Dr. J. L. Parker, Girdler Corp., Tulsa.

Process and Operations—Gen. Middlebrook, Consultant, Tulsa.

Light Hydrocarbons by Pipe Line—J. T. Russell, Panhandle Eastern Pipe Line Co., Liberal, Kansas.

Mechanics of Gas Pipelining—C. H. Swartz, Gulf Oil Corp., Houston.

Petro-Chemicals—Dr. D. G. Zink, Stanolind Oil and Gas Co., Tulsa.

APCA Talks Oil Industry Smog Control Progress

Five papers dealing with various phases of air pollution control and the oil industry's role in meeting this problem are to be presented at the Air Pollution Control Association meeting in Baltimore, May 25-28.

The following talks will be of special interest to oil refiners and processors: "Recording Visibility Meter and its Use in Los Angeles" by Dr. P. L. Magill, Stanford Research Institute; "Use of Masking Agents to Alleviate Odor Problems" by a speaker from the DuPont Co.; "Progress in the Oil Industry in Control of Air Pollution" by Vance N. Jenkins, Union Oil Co.; "Research on Smog" by a speaker from the Stanford Research Institute; and "Oil Industry Viewpoint on the Regulatory Picture" by F. H. Hawkins, of Madison, Pillsbury, Sutro, consultants.

API Refining Division

The complete program for the mid-year meeting of the Division of Refining, American Petroleum Institute, May 11-14, in New York City, appears in the special section in this issue of PETROLEUM PROCESSING, beginning on page 526.

Purdue Waste Conference Scheduled for May 4-6

AT LEAST three papers of interest to petroleum and petrochemical processors have been scheduled for delivery during the Purdue Eighth Industrial Waste Conference, May 4-6, 1953, at Purdue Memorial Union Bldg., Lafayette, Ind. They are:

"The Treatment of Petrochemical Wastes," by C. O. Huntress, J. F. Pritchard & Co., Kansas City, Mo.

"Bacteriological Oxidation of Organic Chemicals," by Vernon T. Stack and E. J. Mills, Carbide and Carbon Chemicals Co., So. Charleston, West Va.

"Operation of Experimental Trickling Filters on Oil-Containing Waste Waters," by R. J. Austin, W. F. Meehan, and J. D. Stockham, research dept., Standard Oil Co. (Indiana), Whiting, Ind.

Registration fee for the entire three-day session has been set at not more than $7.00. Pre-registration is not necessary in order to attend the sessions.

Hotel accommodations are available in the vicinity of the Purdue Campus at Purdue Union Club, Fowler Hotel, Cedar Crest Motel, and Morris Bryant Motel.

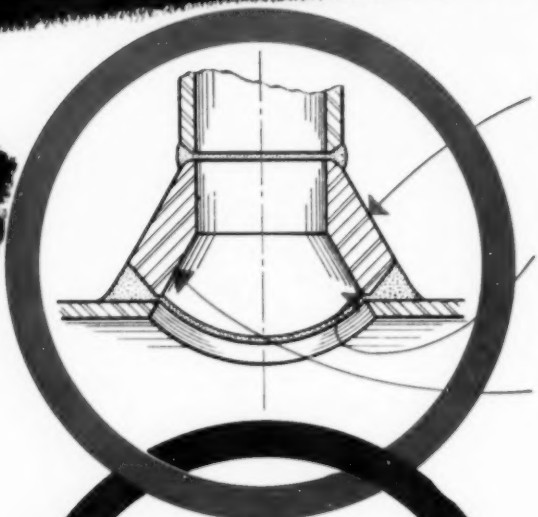
Study Effect of Weather At AIChE-CIC Meeting

How to design a processing plant for operation under extreme cold weather conditions will be discussed by S. V. Antenbring, Imperial Oil Co., Ltd., Sarnia, before a joint meeting of the American Institute of Chemical Engineers and the chemical engineering division of the Chemical Institute of Canada, April 26-29, at the Royal York Hotel, Toronto, Ontario.

Mr. Antenbring will deliver his paper, "Canadian Process Plant Design," at a symposium on chemical engineering processes, Monday afternoon, April 27.

Two other symposiums of particular interest, "Communications for Action in an Organization" and

Engineered Reinforcement Against CORROSIVE ATTACK at Branch Connections



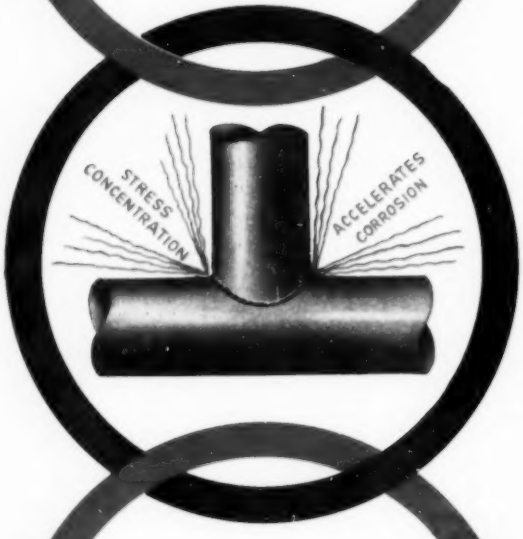
Designed with thick, tapered section to relieve stress concentration.

Additional metal prevents branch connection from corroding dangerously thin.

Funneled inlet relieves stress concentration at point of highest magnitude—the *inside* of the crotch.

Accelerated corrosion due to stress concentrations can be readily eliminated . . . by using WELDOLET WELDING FITTINGS at all 90° branch connections.

When corrosion exists in a piping system, it attacks the points of stress concentration most severely. WHY DOWN-RATE YOUR PIPING SYSTEM BECAUSE OF THIS WEAK LINK?



SPECIFY AND USE . . . . . BONNEY WELDOLET WELDING FITTINGS to insure 100% pipe strength at branch connections under corrosive conditions.

WeldOlets, butt-welding

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(To obtain more data on advertised products see page 600)

Meetings

"Rates of Interphase Mass Transfer" are to be held Tuesday morning, April 28, and Wednesday morning, April 29, respectively.

Oil Man's Calendar

APRIL

22nd National Packaging Exposition, Navy Pier, Chicago, Ill., April 20-23.

American Institute of Chemical Engineers, joint meeting with the **Chemical Institute of Canada,** Royal York Hotel, Toronto, Ont., April 26-29.

American Society of Mechanical Engineers, Spring meeting, Deshler-Wallick Hotel, Columbus, Ohio, April 28-30.

Natural Gasoline Assn. of America, 32nd annual convention, Rice Hotel, Houston, Texas, Apr. 29-May 1.

MAY

Liquefied Petroleum Gas Assn., 1953 convention and exposition, Conrad Hilton Hotel, Chicago, Ill., May 3-6.

8th Industrial Waste Conference, Purdue University Memorial Union Bldg., Lafayette, Ind., May 4-6.

American Petroleum Institute, Division of Refining, mid-year meeting, Hotel Commodore, New York, N. Y., May 11-14.

American Institute of Chemists, annual meeting, Philadelphia, Pa., May 12-13.

International Petroleum Exposition and Congress, Hall of Science, Tulsa, Okla., May 14-23.

Chemical Specialties Mfgrs. Association, mid-year meeting, Drake Hotel, Chicago, Ill., May 17-19.

Materials Handling Exposition, Convention Hall, Philadelphia, Penna., May 18-22.

Scientific Apparatus Makers Association, annual meeting, all sections, The Greenbrier, White Sulphur Springs, W. Va., May 24-28.

Air Pollution Control Ass'n., annual meeting, Lord Baltimore Hotel, Baltimore, Md., May 25-28.

American Society for Quality Control, 7th annual convention, Convention Hall, Philadelphia, Penna., May 27-29.

Western Petroleum Refiners Association, regional meeting, Hotel Broadview, Wichita, Kans., May 28-29.

JUNE

Society of Automotive Engineers, summer meeting, The Ambassador and the Ritz-Carlton Hotels, Atlantic City, N. J., June 7-12.

Manufacturing Chemists Association, joint meeting with **Synthetic Organic Chemicals Mfgrs. Association,** Greenbrier Hotel, White Sulphur Springs, W. Va., June 11-13.

Exposition of Basic Materials for Industry, Grand Central Palace, New York City, June 15-19.

Western Petroleum Refiners Association, regional meeting, Conrad Hilton Hotel, Chicago, Ill., June 18-19.

American Standards Ass'n., Gaillard Seminar On Industrial Standardization, Engineering Societies Bldg., 29 West 39th St., New York, N. Y., June 22-26.

American Society for Testing Materials, annual meeting, Atlantic City, N. J., June 29-July 3.

SEPTEMBER

American Institute of Chemical Engineers, regional meeting, Fairmont and Mark Hopkins Hotels, San Francisco, Calif., Sept. 13-16.

Instrument Society of America, 8th national conference and exhibit, Hotels Sherman and Morrison, Chicago, Ill., Sept. 21-25.

Western Petroleum Refiners Ass'n., regional meeting, Hotel Henning, Casper, Wyo., Sept. 24-25.

OCTOBER

Packaging Institute, 15th annual Forum, Hotel Statler, New York City, Oct. 12-14.

Scientific Apparatus Makers Ass'n., mid-year meeting of recorder-controller section, Seaview Country Club, Absecon, N. J., Oct. 14-16.

Western Petroleum Refiners Ass'n., regional meeting, Garrett Hotel, El Dorado, Ark., Oct. 22-23.

J-M BLAZECRETE speeds refractory repairs...

That's why it pays you to use this hydraulic setting refractory for temperatures to 3000F

REPAIR old refractory linings—or build new ones—quickly and economically with Blazecrete*. For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place.

When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete goes on fast . . . without laborious ramming or tamping. *And Blazecrete linings last.*

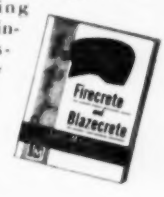
Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix . . . can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.



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Whether you gun it... *or slap-trowel it...*

Johns-Manville **BLAZECRETE**

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(To obtain more data on advertised products see page 600)

THEY'RE LOOKING DOWN YOUR PIPELINE...

Those twin scourges of industry—Lost Production and High Maintenance—are constantly drawing a bead on economical operation . . . looking down this nation's arteries for the lines of least resistance to heat, pressure and corrosion.

There *is* one way to spoil their aim: make sure that *your* pipe and tubing sections are joined with fittings of a kind that match them in chemical and physical properties, in strength and weight.

W-S Double-Diamond FORGED STEEL Fittings in both screw-end and socket-weld types give you all these qualities . . . provide life-of-the-line joints for any kind of make-up.

Literature is available . . . write for it.

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Further Cuts in Allowables Warn of Excessive Crude Run to Stills

MORE caution signs are appearing along the road, to the effect that crude runs to U. S. refiners' stills of around 7,000,000 b/d may prove too large for the normal balancing of product supply and demand in the late spring and early summer.

The Bureau of Mines anticipates a reduction in crude runs in the immediate weeks. It estimates total U. S. crude runs in April at 6,790,000 b/d avg.

California is contributing relatively more to the current high rate of crude runs than the territory east of the Rockies. Crude runs in California in March were 7-8% larger than in March of '52. The increase for the rest of the country was around 5.5%. The caution indicators on U. S. crude runs include:

1—Further cuts in allowable crude oil production in Texas and Louisiana, based on the oil companies' nominations of their coming requirements.

2—Stocks of gasoline, kerosine, distillate fuels and residual fuels are at higher levels than a year ago. Stocks of heating oils (kerosine and distillates) are a fifth higher.

3—Price declines for products in the first weeks of decontrol of petroleum prices by the OPS.

4—Continued high rate of imports of residual fuel oil, which to some extent replaces the product of U. S. refineries in the east coast markets.

Crude runs to stills for the first quarter of '53 were between 4 and 5% higher than a year ago. In 1952 the strike of refinery workers during May reduced operations by one third and gave refiners something to make up in the following months, particularly in gasoline demand. In 1951, the closing down of the Anglo-Iranian refinery at Abadan threw an unexpected demand on U. S. refiners for about 25,000,000 bbls. of products, which continued into 1952 but at a tapering-off rate. In 1950 the start of the Korean war created an emergency demand for refiner's products. What 1953 may bring in the way of unanticipated demand as yet remains to be seen.

Cuts in Allowables—Output of Texas wells was reduced another 120,900 b/d in April by the Texas Railroad Commission, based on reports from oil companies as to the amounts they would require. The cutback in Texas since December has totaled around 380,000 b/d. Louisiana authorities reduced the allowable production there in April, the first cutback in 8 months. Total stocks of crude oil in the U. S. on Jan. 31 were 272,250,000 bbls., about 7% larger than the year before. Crude stocks at refineries, about 66,000,000 bbls., were about 6% over those of Jan. 31, '52.

Product Stocks—Total product stocks (gasline, kerosine, distillate and residual fuels) at U. S. refineries March 28 were 282,054,000 bbls., about 8% higher than the 260,055,000 bbls. of March 29, '52. East of California, total primary stocks March 28 were 239,310,000 bbls., about 5% larger than March 29, '52. The heavy accumulation of distillates and residual fuels in California largely accounts for the difference between the two areas.

East of California, heating oil stocks (kerosine and distillates) March 28, were 69,225,000 bbls., over 17% larger than the 58,966,000 bbls. of March 29, '52. It was nearly the middle of June, a year ago, when this figure was reached. Unless yields are adjusted, the buildup in these stocks in coming months of off-demand will reflect high runs to stills more accurately than other products. Table 1 gives the figures on heating oils by refining districts for the two dates.

Gasoline stocks for the U. S., 162,878,000 bbls. March 28, were only 4,062,000 bbls. larger than on March 29, '52 (less than 3%) and are not considered out of line in relation to anticipated spring and summer demand. East of California, gasoline stocks are only 2,464,000 bbls. higher than at the comparable date the preceding year.

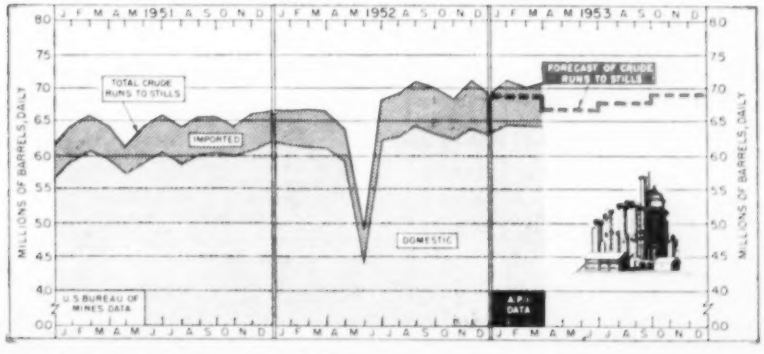
Residual fuel stocks for the U. S. March 28 were 41,002,000 bbls., 4,479,000 bbls. higher than on March 29, '52. The surplus of this product is entirely in California. East of the Rockies residual fuel stocks were 1,278,000 bbls. less than the year before.

Table 1—Heating Oil Stocks at Season's End
(Kerosine and Distillate Fuels, March 28, 1953 and March 29, 1952)

(API Data—1000 bbls.)

District	Mar. 28, '53	Mar. 29, '52	Change	% Change
East Coast	27,796	21,404	+ 6,392	29.9
Gulf Coast	14,368	12,886	+ 1,482	11.5
Total Coastal	42,164	34,290	+ 7,874	22.9
Appalachian	2,035	1,520	+ 515	33.9
Ind.-Ill.-Ky.	12,500	11,119	+ 1,381	12.4
Okla.-Kans.-Mo.	7,595	7,757	— 162	2.1
Other Inland	4,931	5,280	+ 651	15.2
Total East of Cal.	69,225	58,966	+ 10,259	17.4
California	8,949	5,750	+ 3,199	55.6
TOTAL U. S.	78,174	64,716	+ 13,458	20.8

Fig. 1—Runs Hang at 7,000,000 B/D Level



Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
Mar. '53 API*	6,403	628	7,031
Mar. '52 BM	6,145	494	6,639
Change	+ 258	+ 134	+ 392
% Change	4.2	27.1	5.9

*Through Mar. 28

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mos. '53*	378,580	35,848	414,428
2 Mos. '52	371,091	28,262	399,353
Change	+ 7,489	+ 7,586	+ 15,075
% Change	2.0	26.9	3.8

*Feb. estimated from API data

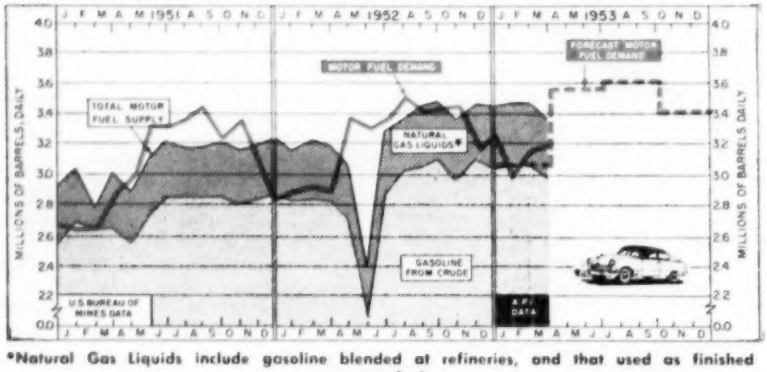
BM Forecast of Crude Runs to Stills, 1953
(Dec. 26, 1952; 1000 b/d avg. by quarters)
1st Q., 6,920; 2nd Q., 6,750; 3d Q., 6,810; 4th Q., 6,972

Yields on Crude Runs to Stills

	Gasoline %	Kerosine %	Dist. Fuels %	Resid. Fuels %
Mar. '53 API*	42.6	5.4	21.0	18.4
Feb. '53 API	43.8	5.8	21.6	18.2
Jan. '53 BM	43.7	6.2	21.7	18.5
Mar. '52 BM	42.6	5.8	21.2	19.3

*Through Mar. 28.

Fig. 2—Gasoline Demand Starts Seasonal Climb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J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
MOTOR FUEL DEMAND
FORECAST MOTOR FUEL DEMAND
TOTAL MOTOR FUEL SUPPLY
NATURAL GAS LIQUIDS*
GASOLINE FROM CRUDE
U.S. BUREAU OF MINES DATA
A.P.I. DATA

*Natural Gas Liquids include gasoline blended at refineries, and that used as finished motor fuel.

Fig. 3—"Gas" Stocks Top March of 1952

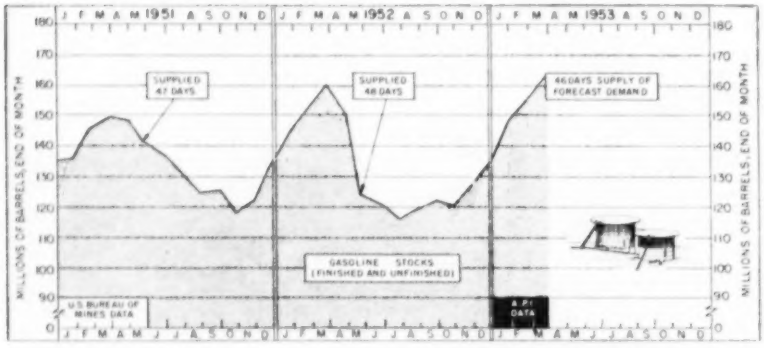

J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 47 DAYS
SUPPLIED 48 DAYS
46 DAYS SUPPLY OF FORECAST DEMAND
GASOLINE STOCKS (FINISHED AND UNFINISHED)
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Fig. 4—Small Drop in Heating Oil Output

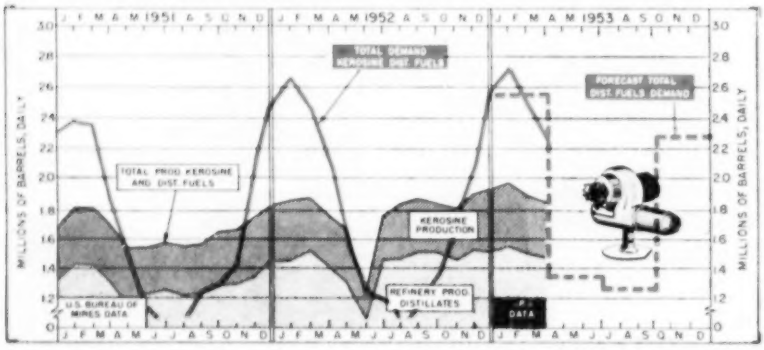
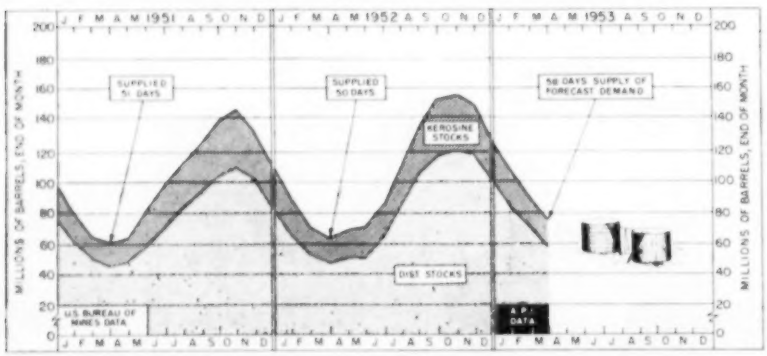

J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL DEMAND KEROSINE DIST. FUELS
FORECAST TOTAL DIST. FUELS DEMAND
TOTAL PROD. KEROSINE AND DIST. FUELS
KEROSINE PRODUCTION
REFINERY PROD. DISTILLATES
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Fig. 5—58 Days Supply of Heating Oil Stocks


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 51 DAYS
SUPPLIED 50 DAYS
58 DAYS SUPPLY OF FORECAST DEMAND
KEROSINE STOCKS
DIST. STOCKS
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended Used Direct	TOTAL
Mar. '53 API*	2,993	390	3,38
Mar. '52 BM	2,810	387	3,197
Change	+183	+2	+186
% Change	6.5	1.0	5.8

*Through March 28

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mos. '53*	181,485	22,584	204,069
2 Mos. '52	169,498	22,187	191,685
Change	+11,987	+397	+12,384
% Change	7.1	1.8	6.5

*Feb. estimated from API data

Motor Fuel Demand

Including Exports
Daily Average (1000 bbls.)

Mar. '53 API*	3,195
Mar. '52 BM	2,888
Change	+307
% Change	10.6

*Through Mar. 28

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mos. '53*	181,407
2 Mos. '52	174,655
Change	+6,752
% Change	3.9

*Feb. estimated from API data

BM Forecast of Motor Fuel Demand, 1953
(Dec. 26, 1952; 1000 b/d avg. by quarters)
1st Q., 3,055; 2nd Q., 3,560; 3d Q., 3,609; 4th Q., 3,402

Gasoline Stocks

Finished and unfinished, end of month (1000 bbls.)

Mar. '53 API*	162,878
Feb. '53 API	157,612
Jan. '53 BM	150,518
Mar. '52 BM	160,689

*Mar. 28

Heating Oils Production

(Kerosine and Distillates)
Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
Mar. '53 API*	381	1,476	1,857
Mar. '52 BM	393	1,485	1,878
Change	−12	−9	−21
% Change	3.1	0.6	1.0

*Through Mar. 28

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mos. '53*	24,826	89,806	114,632
2 Mos. '52	23,782	89,455	113,237
Change	+1,044	+351	+1,395
% Change	4.4	0.4	1.2

*Feb. estimated from API data

Heating Oils Demand

Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
Mar. '53 API*	456	1,771	2,228
Mar. '52 BM	442	1,630	2,072
Change	+15	+141	+156
% Change	3.4	8.6	7.5

*Through Mar. 28

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mos. '53*	31,616	122,669	154,285
2 Mos. '52	32,340	121,673	154,013
Change	−724	+996	+272
% Change	2.2	0.9	0.2

*Feb. estimated from API data

BM Forecast of Heating Oils Demand, 1953
(Dec. 26, 1952; 1000 b/d avg. by quarters)
1st Q., 2,566; 2nd Q., 1,352; 3d Q., 1,250; 4th Q., 2,272

Heating Oil Stocks

(1000 bbls. end of month)

	Kerosine	Dist. Fuels	TOTAL
Mar. '53 API*	18,417	59,757	78,174
Feb. '53 API	20,550	68,025	88,527
Jan. '53 BM	23,487	80,655	104,142
Mar. '52 BM	16,817	48,750	65,567

*Mar. 28

Fig. 6—Imports Big Factor in "Resid" Supply

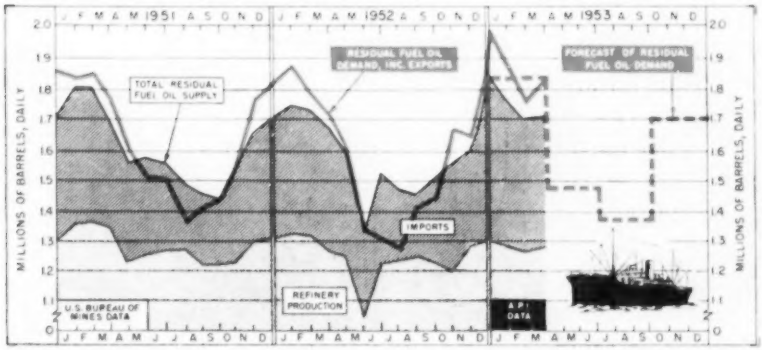
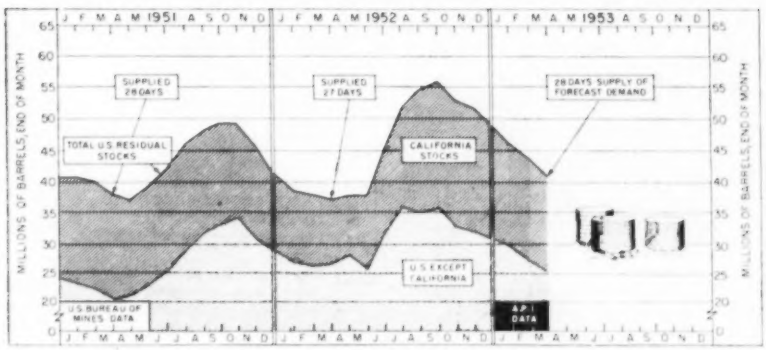

J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL RESIDUAL FUEL OIL SUPPLY
RESIDUAL FUEL OIL DEMAND, INC. EXPORTS
FORECAST OF RESIDUAL FUEL OIL DEMAND
IMPORTS
REFINERY PRODUCTION
U.S. BUREAU OF MINES DATA
API DATA

Fig. 7—Residual Stocks Continue To Drop


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 28 DAYS
SUPPLIED 27 DAYS
28 DAYS SUPPLY OF FORECAST DEMAND
TOTAL U.S. RESIDUAL STOCKS
CALIFORNIA STOCKS
U.S. EXCEPT CALIFORNIA
U.S. BUREAU OF MINES DATA
API DATA

Residual Fuels Production

Daily Average (1000 bbls.)

	Refinery Output	Imports	TOTAL
Mar. '53 API*	1,291	423	1,714
Mar. '52 BM	1,274	411	1,685
Change	+17	+12	+29
% Change	1.3	2.9	1.7

*Through Mar. 28

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mos. '53*	76,226	27,449	103,675
2 Mos. '52	79,835	24,798	104,633
Change	−3,609	+2,651	−958
% Change	4.5	10.7	0.9

*Feb. estimated from API data

Residual Fuels Demand

Daily Average (1000 bbls.)

Mar. '53 API*	1,837
Mar. '52 BM	1,714
Change	+123
% Change	7.1

*Through Mar. 28

Total Demand (1000 bbls.)

2 Mos. '53*	108,928
2 Mos. '52	110,399
Change	−1,471
% Change	1.3

*Feb. estimated from API data

BM Forecast Residual Fuels Demand, 1953
(Dec. 26, 1952; 1000 b/d avg. by quarters)
1st Q., 1,844; 2nd Q., 1,494; 3d Q., 1,370; 4th Q., 1,707

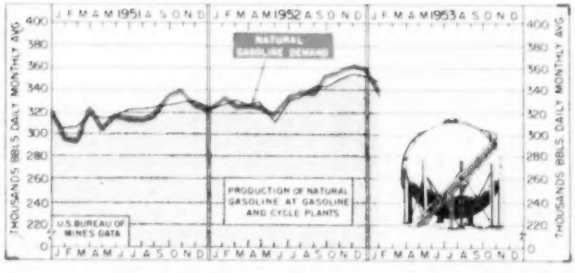
Residual Fuel Stocks

1000 bbls. end of month

	U.S. Except California	TOTAL U.S.
Mar. '53 API*	25,212	41,002
Feb. '53 API	27,578	44,432
Jan. '53 BM	28,794	45,910
Mar. '52 BM	27,161	37,971

*Mar. 28

Fig. 8—Supply and Demand of Natural Gas Liquids


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
THOUSANDS BBLS DAILY MONTHLY AVG
NATURAL GASOLINE DEMAND
PRODUCTION OF NATURAL GASOLINE AT GASOLINE AND CYCLE PLANTS
U.S. BUREAU OF MINES DATA

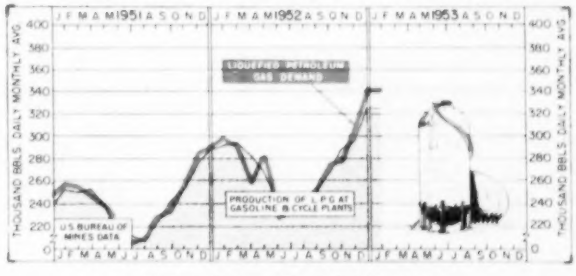
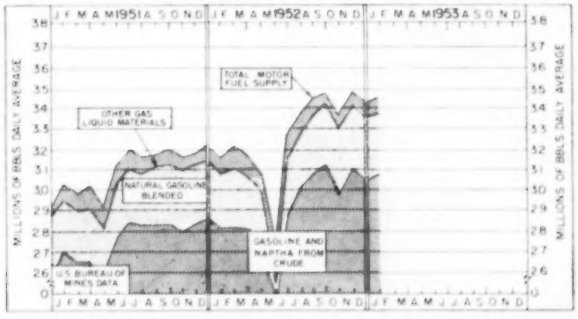

J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
THOUSAND BBLS DAILY MONTHLY AVG
LIQUEFIED PETROLEUM GAS DEMAND
PRODUCTION OF L.P.G. AT GASOLINE & CYCLE PLANTS
U.S. BUREAU OF MINES DATA

Fig. 9—Makeup of U. S. Motor Fuel Supply


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BBLS DAILY AVERAGE
TOTAL MOTOR FUEL SUPPLY
OTHER GAS LIQUID MATERIALS
NATURAL GASOLINE BLENDED
GASOLINE AND NAPTHA FROM CRUDE
U.S. BUREAU OF MINES DATA

(Figures in table in 1000 bbls./day average)

	Gasoline & Naphtha from Crude	Natural Blended	Other Gas Liquid Materials	Total Motor Fuel Supply
Jan. '53	3,084	300	81	3,465
Dec. '52	3,055	307	73	3,435
Nov. '52	3,105	311	80	3,496
Jan. '52	2,821	271	85	3,179

Natural Gas Liquids Statistics

(Source: U. S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Supply* (1000 bbls./day avg.) Natural Gasoline	LPG	TOTAL	Demand** (1000 bbls./day avg.) Natural Gasoline	LPG	TOTAL
Jan. '53*	347	324	671	336	340	676
Jan. '52	327	292	619	332	296	628
Change	+20	+32	+52	+4	+44	+48
% Change	6.1	11.0	8.4	1.2	14.9	7.6
	Total Supply (1000 bbls.)			Total Demand (1000 bbls.)		
12 Mos. '52*	121,120	100,352	223,472	123,863	99,429	223,292
12 Mos. '51	119,977	86,377	206,354	115,383	87,936	203,319
Change	+3,143	+13,975	+17,118	+8,480	+11,493	+19,973
% Change	2.6	16.2	8.3	7.3	13.1	9.8

Stocks, End of Month (1000 bbls.)

	By type of product (At gasoline plants and terminals only): LPG	Natural Gasoline	Con-densate	Finished Gasoline†	By Location: Gasoline Plants	Refin-eries	Total
Jan. '53	1,692	2,134	303	1,451	5,580	1,995	7,575
Dec. '52	2,191	2,011	315	1,207	5,724	2,083	7,807
Nov. '52	2,744	2,133	294	1,287	6,458	2,126	8,584
Oct. '52	2,892	2,399	263	1,185	6,739	2,151	8,890

*Supply includes receipts from refineries as well as current production from natural gasoline and cycling plants. Receipts from refineries in January included 191,000 bbls. of natural gasoline.

**Demand does not include liquefied refinery gases produced for fuel and chemical purposes, which totaled 3,062,000 bbls. in January.

†Includes naphtha and other products.

ADVERTISERS' INDEX

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

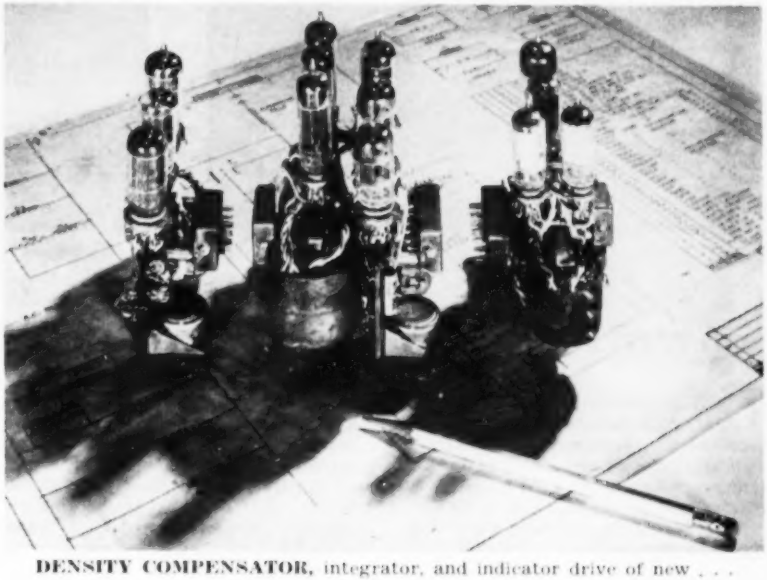
Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

(A-1) AIRETOOL MFG. CO. 577
(A-2) AIR PREHEATER CORP. 570
(A-3) AIR PRODUCTS, INC. 555
(D-1) ALLIED CHEMICAL & DYE CORP., GENERAL CHEMICAL DIV. .....Inside Back Cover
(M-8) ALLIED CHEMICAL & DYE CORP., SOLVAY PROCESS DIV. 466
(A-4) ALLIS CO., LOUIS 498
(A-5) ALUMINUM CO. OF AMERICA (CHEMICAL DIV.) 513
(A-6) AMERICAN BITUMULS & ASPHALT CO. 584
(A-7) AMERICAN DISTRICT STEAM CO., INC. 514
(A-8) AMERICAN LOCOMOTIVE CO. (ALCO PRODUCTS DIV.) 486
(A-9) ANACONDA COPPER MINING CO. 461
(B-1) ANNIN CO., THE 517
(B-2) ASKANIA REGULATOR CO. 614
(B-3) ATLANTIC REFINING CO. 474, 475
(B-4) ATTAPULGUS MINERALS & CHEMICALS CORP. 489
(B-5) "AUTOMATIC" SPRINKLER CORP. OF AMERICA 578
(B-6) BABCOCK & WILCOX CO. (TUB. PROD. DIV.) 503
(B-7) BETHLEHEM STEEL CORP. 566
(B-8) BETZ, W. H., & L. D. 497
(B-9) BLACKMER PUMP CO. 606
(C-1) BLACK, SIVALLS & BRYSON, INC. 605
(C-2) BONNEY FORGE & TOOL WORKS 594
(C-3) BOWSER, INC. 582
(C-4) BROWN FINTUBE CO. 478
(C-5) CATALYTIC CONSTRUCTION CO. 502
(C-6) CHICAGO BRIDGE & IRON CO. .....Facing page 553
(C-7) CHAPMAN VALVE MFG. CO. ..484
(C-8) CONOFLOW CORP. 611
(C-9) COOPER-BESSEMER CORP., THE 479
(D-2) CRANE CO. 465
(D-3) DAVISON CHEMICAL CORP. 500, 501
(D-4) DEAN HILL PUMP CO. 592
(D-5) DUPONT de NEMOURS & CO., INC., E. I. 572, Facing pages 472, 473
(D-6) DURAMETALLIC CORP. 606
(D-7) ENGINERING RESEARCH ASSOCIATES 611
(D-8) ENJAY CO., INC. 483
(D-9) ETHYL CORP. .....Facing page 441
(E-1) FILTROL CORP. 490
(E-2) FISCHER & PORTER CO. 459
(E-3) FLUOR CORP., LTD., THE 508
(E-4) FORTY-EIGHT INSULATIONS, INC. 583
(E-5) FOSTER WHEELER CORP. 576
(E-6) GENERAL AMERICAN TRANSPORTATION CORP. 442, 471
(D-1) GENERAL CHEMICAL DIV., ALLIED CHEMICAL & DYE CORP. .....Inside Back Cover
(E-7) GLIDDEN CO. 613
(E-8) GRAVER TANK & MFG. CO., INC. 452
(E-9) GRAVER WATER CONDITIONING CO. 509
(F-1) GRISCOM-RUSSELL CO., THE .. 493
(F-2) HAMMEL-DAHL CO. 468
(F-3) HARSHAW CHEMICAL CO. 458
(F-4) HETHERINGTON & BERNER, INC. 611
(F-5) HOUDRY PROCESS CORP. 586
(F-6) INSUL-MASTIC CORP. OF AMERICA 446
(F-7) INTERNATIONAL NICKEL CO. .. 485
(F-8) JERGUSON GAGE & VALVE CO. 571
(F-9) JOHNS-MANVILLE CORP. 595
(G-1) KELLOGG CO., THE M. W. 585
(G-2) KOCH ENGINEERING CO. 476
(G-3) KULJIAN CORP., THE 589
(G-4) LITTLE, INC., ARTHUR D. 568
(G-5) LUMMUS CO., THE 460
(G-6) MARLEY CO., THE 516
(G-8) MERIAM INSTRUMENT CO., ... 615
(G-9) METAL TEXTILE CORP. 444
(H-1) MIDWEST PIPING CO., INC. .. 492
(H-2) MILTON ROY COMPANY 574
(H-3) MINNEAPOLIS-HONEYWELL REGULATOR CO. 495
(H-4) MIXING EQUIPMENT CO. 520
(H-5) MONSANTO CHEMICAL CO. ... 488
(H-6) NATIONAL AIROIL BURNER CO. 612
(H-7) NATIONAL FOAM SYSTEM, INC. 506
(H-9) NATIONAL LEAD CO. 499
(H-8) NATURAL GASOLINE SUPPLY MEN'S ASSOC. 518
(I-1) NICHOLS ENGINEERING CO. .. 579
(I-2) NICHOLSON & CO., W. H. 604
(I-3) NORDSTROM VALVE DIV., ROCKWELL MFG. CO. ....Facing pages 488, 489
(I-4) NORTON CO. 482
(I-5) OAKITE PRODUCTS, INC. 612
(I-6) OHIO STEEL FOUNDRY CO., THE 610
(I-7 OIL WELL SUPPLY CO., DIV., ... U. S. STEEL CORP. 455
(I-8) ORBIT VALVE CO. 580
(I-9) ORONITE CHEMICAL CO. 608
(J-1) PACIFIC PUMPS, INC. 588
(J-2) PETRO-CHEM DEVELOPMENT CO., INC. .....Facing page 552
(J-3) PETROLEUM RECTIFYING CO. . 451
(J-4) PHILLIPS PETROLEUM CO. (PERCO DIV.) 472
(J-5) PITTSBURGH LECTRODRYER CORP. 505
(J-6) PORTER CO., H. K.; WATSON-STILLMAN FITTING DIV. 596
(J-7) WM. POWELL CO., THE 491
(J-8) % PROPORTIONEERS, INC. %.. .....Inside Front Cover
(J-9) REFINERY ENGINEERING CO. . 504
(K-1) RIDGE TOOL CO., THE 607
(I-3) ROCKWELL MFG. CO., NORDSTROM VALVE DIV. .....Facing pages 488, 489
(K-2) ROCKWELL CO., W. S. 606
(K-3) RONNINGEN MFG. CO. 614
(K-4) RUST-OLEUM CORP. 507
(K-5) SCHUTTE & KOERTING 487
(K-6) SHELL CHEMICAL CORP. 519
(K-7) SHERWIN-WILLIAMS CO., THE 591
(K-8) SIER BATH GEAR & PUMP CO. 609
(K-9) SMITH CORP., A. O. 448
(M-8) SOLVAY PROCESS DIV., ALLIED CHEMICAL & DYE CORP. 466
(L-1) STONE & WEBSTER ENGINEERING CORP. 512
(L-2) TAYLOR INSTRUMENTS CO. 560, 561
(L-3) TRETOLITE CO. 473
(L-4) UNION ASBESTOS & RUBBER CO. 494
(I-7) U.S. STEEL CORP., OIL WELL SUPPLY CO., DIV. 455
(L-5) U.S. STONEWARE CO. 496
(L-6) UNIVERSAL OIL PRODUCTS CO. 480, 481
(L-7) VERNON TOOL CO. 575
(L-8) WALLACE & TIERNAN PRODUCTS, INC. 590
(L-9) WARNER LEWIS CO. 604
(M-1) WARREN PETROLEUM CORP. . 464
(J-6) WATSON-STILLMAN FITTING DIV., H. K. PORTER CO. 596
(M-2) WEDGEPLUG VALVE CO. 510, 511
(M-3) WESTINGHOUSE ELECTRIC CORP. .....456, 457 & 477
(M-4) WOLVERINE TUBE DIV., CALUMET & HECLA, INC. 441
(M-5) WORTHINGTON CORP. 467, 515
(M-6) WRIGHT CHEMICAL CORP. 613
(M-7) WYATT METAL & BOILER WORKS .....Outside Back Cover

WHAT'S NEW...

FLOW SENSING element, and . . .



DENSITY COMPENSATOR, integrator, and indicator drive of new . . .

Mass Flowmeter Integrates Flow and Density

FOR many years, flowmeters have measured in volumetric terms. It was the direct way, and the indication was simple to calibrate in whatever values were desired—gals. or cu. ft. or cu. cms. per unit of time.

More recently, however, processors and users of fluid materials have been interested in getting their flow in terms of weight. Last month, one new "mass" flowmeter was introduced in which the weight per unit time was measured directly by means of the Coriolis acceleration (PETROLEUM PROCESSING, March, 1953, p. 426, "What's New" No. 5).

Another way to obtain mass flow would be to measure volumetric flow and multiply it by the density of the fluid. And that's essentially what has been done in the new Gavco electronic mass flowmeter, introduced a few weeks ago.

Fluid passes through the sensing element (see photo at left), turning a bladed rotor. This in turn intersects a magnetic field and the impulses are picked up in an electronic circuit, the signals varying linearly with the flow. A separate sidestream is taken off the sensing element tube and sent through a density comparator. This signal is integrated with the volumetric flow signal and the result is indicated or recorded in weight terms.

The continuous density detector measures variations in density to 1%. The volume sensing element measures flow rate to ½% through the full flow ratio of 1/60. Pressure drop through the element is less than 1 psi. at 20,000 pph.

Originally designed for use in aircraft, particularly jet engine operation, but also reciprocating engines and in air-to-air refueling; the Gavco mass flowmeter is expected also to have wide application in the processing industries. It can be used in reaction processes, in filtration, extraction, and others. The unit also has use in bulk storage and loading of products, where daily temperature affects fluid density. And finally, it will find a place in laboratory and research operations.

Units for aircraft operation are available now; units for commercial use will be made available in the near future. The latter operate on 110 volt, 60 cycle, single-phase, A.C. Gavco Corp., 540 East 80th St., New York 21, N. Y.

Circle No. **1** *on Reply Card*

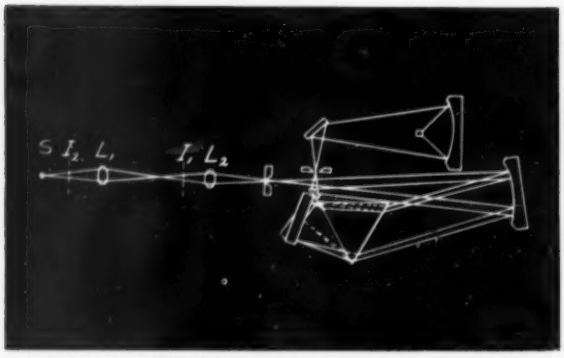
Oil Soluble Rust Inhibitor Is Developed for Gasoline Use

. . . in tanks, tankers, and product pipelines. "Kontol 77" is a liquid, semi-polar, organic corrosion preventive designed to combat acidic constituents in hydrocarbons, such as sulfides and chlorides, as well as rust from oxygen. It is permissible for use in avgas to pass Air Force specifications. It also has detergent properties and some gum inhibiting qualities, making it useful for treatment and stabilization of Diesel fuels and furnace oils. As a rust preventive in 100-octane gasoline, it provides rust-freedom under a modification of ASTM D665-50T at a concentration of 1 lb./1000 bbl. Its physical properties are: density at 60° F., 0.861; COC flash pt., 165° F.; fire pt., 180° F.; pour pt. (D97-47), —10° F.; color, 6 minus on ASTM Union colorimeter. Tretolite Co., 937 East Pacific Ave., Webster Groves 19, Mo.

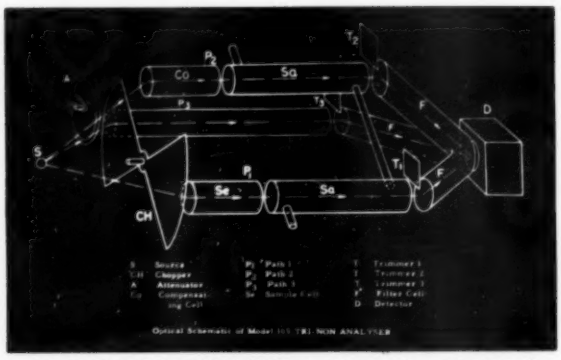
Circle No. **2** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage required.



DISPERSION TYPE infrared analyzer, the "Bichromator"



NON-DISPERSION TYPE analyzer, the "Tri-Non"

Two New Process Analyzers Use Infrared

CONTINUOUS control of process streams is made possible by two new infrared analyzers designed specifically to analyze constituents, and announced recently by Perkin-Elmer Corp.

The Model 93 "Bichromator" analyzer—a two-color or wavelength analyzer—records the ratio of any two predetermined wavelengths. A dispersion type, it operates on either liquid or gas streams. The Model 105 "Tri-Non" analyzer—a triple beam, non-dispersion analyzer—is used where there is considerable interference between the analytical infrared wavelength of the component under analysis and other components in the process stream.

A number of the instruments are scheduled for trial runs in some selected plants. For example, six units are being installed at the new acrylonitrile plant of American Cyanamid Co. in Louisiana. However, instruments will not be available generally until next year. Cost is expected to be in the neighborhood of $7500, including accessories.

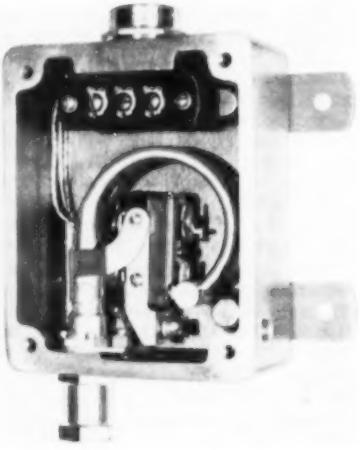
Both types of instruments are thermostated to operate between 0 and 120° F. Each is mounted in an explosion-proof case meeting Class I Group D requirements. On each instrument, the signal appears as a shaft position and may be transmitted to a recorder located remotely from the analyzer.

The Bichromator consists of three basic units: 1) source, 2) monochromator and detector, 3) sample cell. The first two are separately enclosed and pressurized with electrical connections as the only entrant members. Its operation is illustrated in the sketch above.

Radiation from source S is focussed by Lens L_1 in sampling area between L_1 and L_2. Lens L_2 focusses the radiation on the slit where it passes through the dispersion system. A split Littrow mirror permits selection of the two analytical wavelengths. These are successively brought to a focus on the detector. I_1 and I_2 represent the two Littrow mirror images.

Operation of the Tri-Non is shown in the other drawing above. Infrared radiation from a source S is transmitted by internal reflection through three paths P_1, P_2, and P_3 to a single selective detector D. D is filled with a gas, usually the component to be analyzed. The gas absorbs radiation at the wavelengths of characteristic absorption, is heated, and causes deflection of a flexible diaphragm which is one side of a condenser. The electrical signal resultant from a change in condenser capacity with delection is then a measure of the radiation incident on the detector, and it varies with the concentration of the component in the sample cell *Sa*. The components in the paths vary with the problem, but in the general case are as shown: P_1—sample *Sa*, sensitizing *Se*, and filter *F* cells; P_2—sample *Sa*, compensating *Co*, and filter *F* cell. The chopper *CH* varies the radiation beams so that the detector *D* successively sees radiation from P_1, P_3, and P_2. The Perkin-Elmer Corp., Norwalk, Conn.

Circle No. **3** *on Reply Card*



New Pressure Switch Actuates Over Range 15 to 10,000 psi.

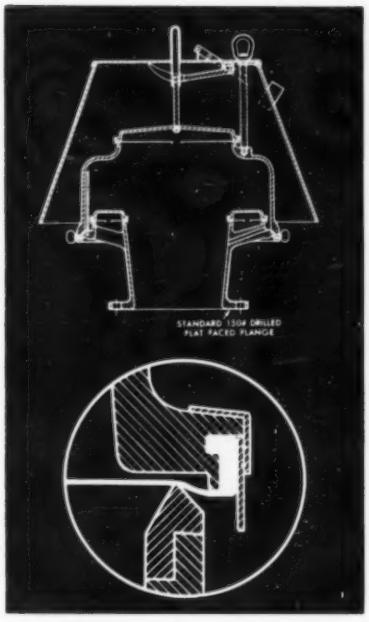
. . . with accurate sensing. The "Meletron" Model 314 comes in six classes of proof pressures (to 500, 1500, 3000, 4500, 6000, and 12,000 psi.). It will actuate at any predetermined pressure over the adjustable range, is available with external adjustment if setting requires frequent changes. Actuation may be on increasing or decreasing pressure, automatically reset by snap action of the switch. A companion model 304 is a skeleton switch, with the same operating characteristics but without case. Barksdale Valves, 1566 E. Slauson Ave., Los Angeles 11, Calif.

Circle No. **4** *on Reply Card*

Multiple Extraction Rack Is Also Useful for Running Distillations

. . . or digestions. The racks have special "Ohmite" rheostats that are rated and tested for continuous service at maximum wattage. Cast aluminum hot plates have nichrome heating elements. Materials of construction of the rack are either aluminum or stainless steel. Range of the equipment is 125 to 300 watts, roughly 225 to 650° F. The six-unit rack (illustrated) has an overall size 30 in. wide x 11 in. deep x 36 in. high, 9 in. to top of hot plates. Width of a smaller, 2-unit rack is 10 in. Special units for 230 volts, 12 units or larger, can be furnished. Labline, Inc., 217-221 N. Desplaines St., Chicago 6, Ill.

Circle No. **5** *on Reply Card*



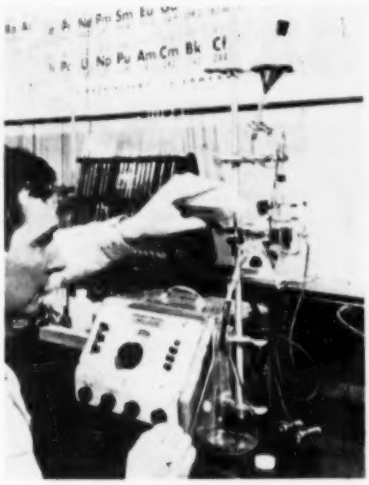
Tank Vapor Vent Designed for Higher Flow at Low Pressures

. . . than have been available heretofore, it is said. The new V-130 "Hi-Flo Vapor-Tite" Membrane Seating Conservation Regulator has an effective area on the pressure side of 54.7 and on the vacuum side of 69.3 sq. in. in the 6-in. valve size. In the 12-in. valve, areas are 220.35 on the pressure and 250.8 sq. in. on the vacuum side. Vapor seal is provided positively by the Buna N membranes, stretched across both the pressure and vacuum valve pallets. Beads around the edges of the membranes are snapped into grooves cut in the edges of the pallets, and are held in place with a non-corrosive aluminum drop ring. Valve bodies are of semi-steel castings. An opening in the center of the pressure membrane permits tank pressures exerted against the bottom of the membrane to be applied also on top. This forces the membrane to adjust itself and conform to any unevenness or irregularity of the seating ring. A similar situation applies at the vacuum membrane, utilizing atmospheric pressures. Outside circular hood is aluminum, mounted on stainless steel posts. Valves are non-freezing. Johnston & Jennings Co., 6917 Bessemer Ave., Cleveland 27, Ohio.

Circle No. **6** *on Reply Card*

New Direct Reading Instrument Measures TEL in Gasolines

. . . in ml./gal. In the electronic "TEL-Meter," Standard Oil of Indiana and Fisher Scientific Co. have translated an ASTM proposal into a laboratory device. Calibrated to report 0 to 5 ml. of TEL per gallon of fuel, the instrument is as accurate as the slower, conventional gravimetric method, it is said. It is based on the principle of polarography. Metal ions are deposited on falling drops of mercury, picking up Hg electrons, and generating a tiny electrical current proportional to the concentration of the metal sample. Troublesome variables are eliminated by means of a second, or "pilot" ion, in this case cadmium, put into the solution in known concentrations. Its current is governed by the same factors governing the lead current. Thus, when the ratio of the two currents is taken, variables are cancelled out. The meter measures the two currents, takes their ratio, and figures the lead concentration, reporting it in terms of TEL. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Penna.



Circle No. **7** *on Reply Card*

DID YOU MISS THESE?

The following items, reviewed originally in the February issue, have aroused considerable interest. They are repeated briefly as a service to those who might have missed them the first time. For details or literature, use the regular Reply Card in this issue.

Telephone Hose Mask Combined For Safety in Cleaning Tanks

. . . by providing two-way communication between workers inside and outside. Tried out in underground fuel storage tanks at Tinker Air Force Base, Oklahoma City, the "Maskfone" enables the man inside to report if he needs more air; if the air hose becomes fouled on an obstruction; or to advise of any unusual hazard. The idea was borrowed from deep-sea diving practice. No outside power source is needed for voice transmission, even over several miles of connecting cable. In effect, the voice vibration provides the needed power. Connecting cable is neoprene covered. Maskfones can also be used in types other than hose masks; for example, canister, tank, or oxygen generating types. Mine Safety Appliances Co., Pittsburgh, Penna.

Circle No. **8** *on Reply Card*

Tiny Purge Flowmeters Permit Manual Control of Small Flows

. . . at low cost with good reproducibility, but moderate accuracy. Typical applications for the new S&K Purge Rotameter include: flow of supply air in bubbler type liquid level measuring; flow of purge fluid in lines between primary elements and differential head flowmeters; flow of transparent purge fluid to sight glass indicators of Rotameters handling opaque fluids; flow of sample fluid to continuous chemical analyzers. The meters include a back flow check valve. A flow control valve covers the entire range of the meter at differential pressures between 1 and 100 psi. Schutte and Koerting Co., Dept. M-C, Cornwells Heights, Bucks County, Penna.

Circle No. **9** *on Reply Card*

Insulation Specs for Refineries

. . . and chemical process plants is the subject of a new 52-page brochure; a detailed reference with specifications for insulation for service above and below 100° F., for tanks, and for oil heaters; including thickness recommendations in seven tables. Johns-Manville, 22 East 40th St., New York 16, N. Y.

Circle No. **10** *on Reply Card*

Caustic Soda Information

. . . useful to the chemist, process engineer, purchasing agent; data on grades, manufacturing processes, analytical methods, shipping and handling precautions, containers, materials of construction for storage tanks. 56-page booklet. Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandote, Mich.

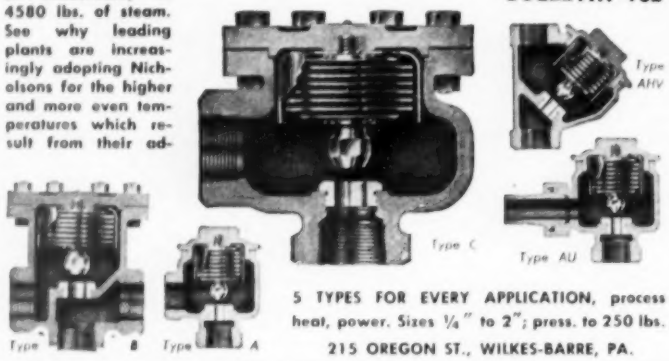
Circle No. **11** *on Reply Card*

NICHOLSON TRAPS

SAVE 4580 LBS. OF STEAM per CYCLE

A large user of steam on the west coast reports that substitution of Nicholson traps for a mechanical type effected a cyclic saving per dryer of 550 gallons of condensate, or 4580 lbs. of steam. See why leading plants are increasingly adopting Nicholsons for the higher and more even temperatures which result from their advanced features: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting.

BULLETIN 152



5 TYPES FOR EVERY APPLICATION, process heat, power. Sizes ¼" to 2"; press. to 250 lbs.

215 OREGON ST., WILKES-BARRE, PA.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Send for descriptive bulletin CT-102

VISIT US AT THE IPE BOOTHS 46-59 CALIFORNIA BLDG. TULSA MAY 14-23

EXCEL-SO

CALIBRATING TANKS

for

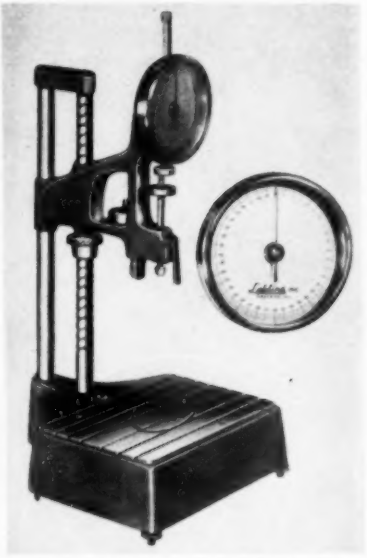
REFINERIES
TERMINALS
PIPE LINES
TANK TRUCKS
LOADING RACKS
PUBLIC SEALERS

We have built hundreds of these provers in all capacities from 50 gallons to 50 barrels. . . . This experience enables us to deliver a REAL PRECISION INSTRUMENT that is Guaranteed. Building, calibrating and guaranteeing a calibrating tank is specialized, painstaking work and is definitely "out" of the price-per-pound category. These tanks are designed to conform to the A.P.I. tentative code #1101, but may be furnished with such modifications as you, the customer, may require.

WARNER LEWIS COMPANY

BOX 3096 • TULSA, OKLAHOMA

What's New!



Universal Penetrometer Design Handles All Types of Needles

. . . including the new micro-cone. The new "Labline" Penetrometer No. 4100 has a 5-in. dial, direct reading to 40 mm., in 400 divisions of 0.1 mm. each. Penetration shaft is kept in rigid alignment by two bearings, independent of depth rod. It can be removed for weighing or changing to other plungers in two seconds without disassembling the head. Built-in height adjustment is controlled by a single knob giving both fine micrometer and coarse rapid adjustment. Aluminum base, 9½ x 6 ½ x 3 in. high, has a circular centering groove for grease cups and sample cans. Overall size of the instrument is 18 x 11 x 10 in. It is furnished with one 50-gm. and one 100-gm. weight, less needle or cone. Net weight is 10 lbs.; shipping weight, 25 lbs. Labline, Inc., 217 No. Desplaines St., Chicago 6, Ill.

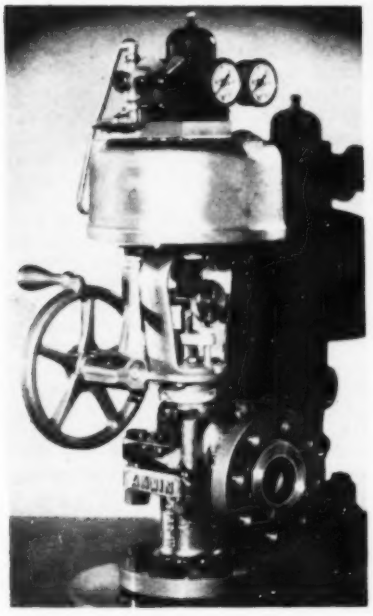
Circle No. **12** *on Reply Card*

Centrifugal Belt-Drive Blower Units Offered in Sizes to 30 in.

. . . with an adjustable motor pulley to provide for speed variations to meet changing requirements. These utility blowers, which start in size at 9-in., are available with either clockwise or counterclockwise rotation. Housings are rotated easily at the time of installation to any of eight discharge positions. Wheels are dynamically balanced to eliminate vibration and insure quiet operation. Blowers can be furnished with motors to meet all current characteristics and special needs. A weatherproof drive cover, available at extra cost to fit all sizes, eliminates the need for penthouse or other special protection. Hartzell Propeller Fan Co., Piqua, Ohio.

Circle No. **13** *on Reply Card*

What's New!



Automatic Control Valve Has Handwheel for Extra Control

. . . during start-ups or on temporary shutdowns for instrument repair. The Annin Models 1520 and 1560 SMW employ the Domotor control unit plus the side-mounted handwheel. Applications for the auxiliary manual control include adjusting steam flow to turbines or engines, fuel to engines, and when batches are being processed intermittently. The handwheel may also be used as an adjustable limit stop for the automatic valve plug. Accuracy on the positioner is up to 1/1000 of valve travel. The standard series of valves withstand operating pressures to 5000 psi., with special applications to 50,000 psi. Effective temperature ranges from —100 to 450°F. (the latter with Teflon packing). The Annin Co., 3500 Union Pacific Ave., Los Angeles 23, Calif.

Circle No. **14** *on Reply Card*

Space-saving Console Indicator Scans up to 200 Temperatures

. . . from thermocouple stations as fast as an operator can log them.

Storing flammable material?

MODEL VVFA

Get Savings and Safety with the BS&B COMBINATION

VENT VALVE FLAME ARRESTER

One compact valve assembly gives safe, satisfactory relief and protection to storage tanks containing flammable material. This high efficiency unit has excellent flow characteristics. Arrester bank consists of network of capillary openings. Rubber to metal seating means high vapor conservation and gives a quick, tight seal when needed to shut off oxygen supply and automatically extinguish flame. Maintenance time is cut in half; cost is even lower. Let us show you why!

1 Positive Pressure Relief

2 Saves Costly Vapor Loss

3 Eliminates Fire Hazard

Seventeen outstanding features of BS&B Pressure Vacuum Vent Valves. Get the complete story. Write for FREE copy of Bulletin E-601. Better still, ask your BS&B Man to study your particular requirements. He can give you the solution you want! Write today . . . no obligation.

SAFETY BS&B HEADS

BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-D4

7500 East 12th Street Kansas City 26, Missouri

Which butterfly valve better meets your needs?

In either of these or any other valves, manual or automatic, which W. S. Rockwell builds for your exact needs, you're sure to get the right type and size to best meet the conditions of operating pressure, temperature and nature of fluid handled, whether it be air, gases, water, liquid or semi-solid chemical materials.

It will pay you to learn how Rockwell Valves can meet your plant's flow control requirements.

Rockwell stainless steel valve; with air cylinder operator and valve positioner; for throttling gases at 1200° F.

Rockwell heavy duty valve for 50 p.s.i. working pressure; has a replaceable rubber liner for valve body and stainless steel blade; with a motor operator and handwheel declutching unit.

Write for Valve Catalog

W. S. ROCKWELL COMPANY

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2533 ELIOT STREET • FAIRFIELD, CONN.

What's New!

The new electronic unit incorporates the L&N Model D Speedomax indicator in a housing that can be pulled out on tracks from the center of the console. A seated operator can read the 25½-in. drum-type scale easily in its 60° sloped housing. Balancing time is 4 secs full-scale, 2.5 secs. half-scale. Scale is calibrated for single or double ranges. Indicator extends only 13 in. above desk, providing unobstructed view of main control panel, making it easy to follow graphic panel diagrams during heat-balance checks, or for other purposes. Switch panels are removable. They hold as many as 100 toggle type switches for 200 Indicator or 100 Indicator and Recorder readings. Horizontal legend strip holders mount next to switches and handles of the toggle switches can be color-coded. There is ample panel space on the console for signal lights, gages or other accessories. Terminal boards are at the center in back and accessible through wide-opening doors. Only connections required to put the unit into operation are the thermocouple extension leadwires and the line voltage supply. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Penna.

Circle No. **15** *on Reply Card*

I've been making DURAMETALLIC Packings for over 20 Years!

DAN SMITH
23 years' experience in producing Durametallic Packings.

It pays to specify packing that has been produced by *packing specialists*. A score of men, like Dan, have been with the Durametallic Corporation for periods of 10 - 20 and 25 years. Convincing evidence why Durametallic Flexible Metallic Packings are performing the most dependable sealing jobs in industry.

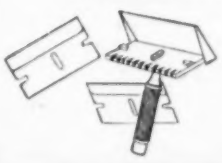
The PERFECT SEAL

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN.

BLACKMER PUMPS...

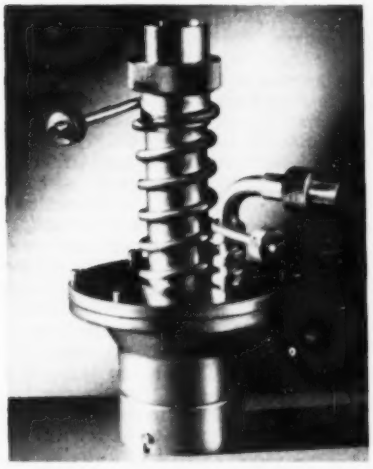
LOW MAINTENANCE COST

SELF-ADJUSTING-FOR-WEAR VANES ARE REPLACEABLE LIKE BLADES IN A RAZOR...



Write For Bulletin 307

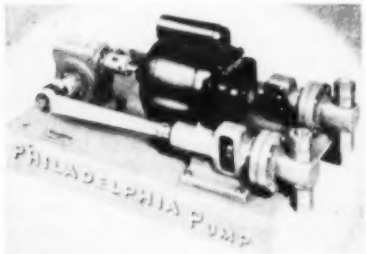
BLACKMER PUMP COMPANY
GRAND RAPIDS, MICHIGAN



Oil Diffusion Vacuum Pump Is Designed for Quick Disassembly

. . . . and easy disconnecting. The Cenco Supervac OD-25 offers a solution to the problem of possibly frequent and rapid necessary cleaning and refilling because of occasional contamination of the oil. The unit consists of only three basic parts, the jet manifold, the jacket, and the boiler with its detachable heater. The jet manifold, a three-stage unit of welded steel, fits snugly in the boiler compartment and is totally enclosed by the jacket. Six Allen screws hold the jacket and boiler together and a synthetic rubber "O" ring provides a vacuum-tight seal. Jets and internal surfaces can be cleaned without disturbing connections to the vacuum or cooling systems. All parts of the pump are of cold rolled steel except the brass couplings and the copper cooling coil. The exterior finish is copper and nickel plated, and the inside is copper plated to prevent rusting. Central Scientific Co., 1700 Irving Park Rd., Chicago 13, Ill.

Circle No. **16** *on Reply Card*



New Proportioning Pump Built For Easy Removal of Parts

. . . without breaking pipe connections. The packing gland in the controlled capacity pump is open at both ends, to simplify replacement of packing and assure even take-up on the packing. The grease lantern ring is readily changed to a water

Millions of users agree—
you cut more pipe with less work
with RIDGID
Heavy-Duty Cutters

There's a big difference in pipe cutters—and you're sure of it the first time you slap a RIDGID on a pipe (any kind) and see how easily cleanly it rolls through the metal. Beautifully balanced for easy action. Factory tested for perfect tracking—and guaranteed warp-proof housings of special malleable hold it. High alloy thin-blade or heavy-duty cutter wheels that leave practically no burr. You cut pipe fast with least effort. Ask your Supply House for the more-for-your-money RIDGID.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

(To obtain more data on advertised products see page 609)

To meet price and performance specifications

ORONITE LUBE OIL ADDITIVES

are tailor-made to your base oils

Why not talk over your problem with us?

You will find Oronite Additives offer important savings in treating costs because of the high quality detergent and inhibitor chemicals from which they are made. Oronite's standards are rigidly high so you can be sure of uniformity in your finished oil.

An additive specialist will call on you on request. Phone or write the Oronite office nearest you.

ORONITE CHEMICAL COMPANY

THE NAME TO WATCH IN CHEMICALS

With Oronite Additives you can formulate oils to meet the new A. P. I. Service Classifications and can meet specifications for 2-104-B, Mil-O-2104, Supplement 1 and Series II oils.

ORONITE CHEMICAL COMPANY

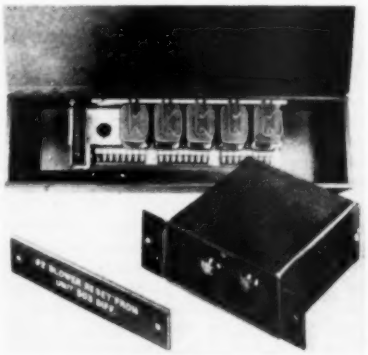
30 SANSOME STREET, SAN FRANCISCO 4, CALIF.
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
STANDARD OIL BLDG., LOS ANGELES 15, CALIF.
600 S. MICHIGAN AVENUE, CHICAGO 5, ILL.
MERCANTILE SECURITIES BLDG., DALLAS 1, TEXAS

2020

What's New!

seal for handling suspended solids or corrosives. The unit can be used in single, dual, or multiple combinations. Top suction and both discharge valves are spring-loaded with stainless steel springs. Valves are stainless steel, machined of solid bar stock, eliminating pressed seats. Valve balls are also of stainless. Special materials of construction are available. Conventional screw and rocker arm micrometer adjustments of stroke length are available, as is also manual, pneumatic, hydraulic, or electrical control of stroke length during operation. Minimum capacity of the smallest unit in the line is 5 cc./hr.; max. capacity is 128 gph. Pressure range is to 20,000 psi. Immediate deliveries can be made from stock. Philadelphia Pump and Machinery Co., Wynnewood, Pa.

Circle No. **17** *on Reply Card*



Trouble Signals Can Be Located Remotely, Anywhere in the Plant

. . . by means of a new alarm system adapter. The "Panalarm" unit permits visual signals to operate as part of a common, plant-wide audio-visual annunicator system. The remote signal unit itself can be furnished as either individual back-lighted nameplates or bullseye lamps. The lamps may also be used with separate on-off lights to form a three-light control station. All signals connect to a common horn or bell, which must be acknowledged by the operator when an "off-normal" condition develops. All moving parts and contacts are enclosed in hermetically sealed plug-in units that are corrosion-proof and suitable for Class I, Division 2 locations. Additional signals can be added to the system by inserting plug-in units into chassis receptacles. The Adapter cabinet is pre-wired for all standard audio-visual sequences. They may be interchanged in the field by simple terminal connections. Cabinets are available for any desired number of signals, and operate from any type of remote contact devices. Panalarm Products, Inc., 6312 N. Broadway, Chicago 40, Ill.

Circle No. **18** *on Reply Card*

(To obtain more data on advertised products see page 600)

Trade Literature

Mass Spectrometer

. . . in a new model, No. 21-610, for accurate, fast process monitoring and control, designed specifically for the petroleum processing or chemical plant, or the laboratory; with a range from mass 12 through 40 with satisfactory separation, or to mass 80 where this separation is not important. *Bulletin CEC*-1824. Consolidated Engrg. Corp., 300 No. Sierra Madre Villa, Pasadena 15, Calif.

Circle No. **19** *on Reply Card*

Vapor-Saving Tanks

. . . using a tubular diaphragm as a breathing "lung". The "Dialift" Tank is covered in detail in *Bulletin* 53 *DL*. Hammond Iron Works, 630 Fifth Ave., New York 20, N. Y.

Circle No. **20** *on Reply Card*

Viscosity Control

. . . with viscometers designed for recording or recording-controlling, in range from 0.2 to 200,000 centipoises, operating on a piston principle; *Bulletin* V1000E gives principle of operation, general technical information. Norcross Corp., 247 Newtonville Rd., Newton 58, Mass.

Circle No. **21** *on Reply Card*

Motors and Generators

. . . are the subject of a 50-page reference, *Booklet* 51R7933, designed to assist in selecting power for most industrial applications, and reprinted from the 1952 edition of *Lincoln's Industrial-Commercial Electrical Reference*. Allis-Chalmers Mfg. Co., 836 S. 70th St., Milwaukee, Wis.

Circle No. **22** *on Reply Card*

Air-Cooled Heat Exchangers

. . . of the so-called "Fin-Fan" type, a forced draft design, for liquids or gases at pressures up to 5000 psi. and temperatures to 1500° F.; a 12-page descriptive booklet, Bulletin No. FF-FD-0.001. Fluor Corp. Ltd., 2500 S. Atlantic Blvd., Los Angeles 22, Calif.

Circle No. **23** *on Reply Card*

Pipe Tape Insulation

. . . of polyvinyl chloride, for protecting pipe against corrosion under or above ground: *Scotchrap Pipe Insulation No.* 50 *and* 51, a four-page detailed bulletin. Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

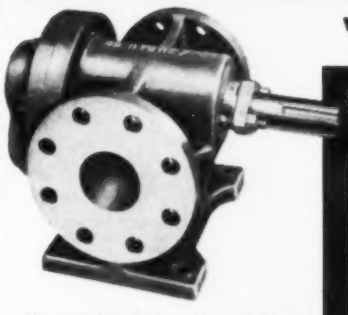
Circle No. **24** *on Reply Card*

Armour Research for Industry

. . . is described completely in the new 1952 annual report for the Foundation; about 60 pages, well-illustrated, covering all phases of the

SIMPLICITY CUTS COSTS

when you buy and use the



New Sier-Bath "Hydrex" PUMPS

For pumping fluids and semi-fluids, 32 SSU to 250,000 SSU. Capacities 1-500 GPM; 300 PSI for continuous duty, 500 PSI for intermittent service.

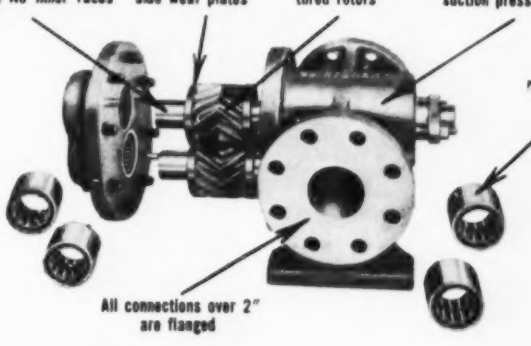
Shafts hardened and ground at bearings. No inner races required.

Easily replaceable side wear plates

Precision manufactured rotors

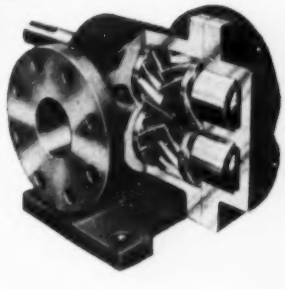
Only one stuffing box (under suction pressure)

Heavy duty roller bearings



All connections over 2" are flanged

New Simplified Design Allows High Quality at Low Cost



- Hydraulically balanced axially
- Shaft hardened and ground at stuffing box. Minimizes wear.
- Easy to assemble, disassemble—cuts maintenance costs.
- All machined surfaces ground for easier piping, aligning
- Short, large diameter shafts
- Horizontal or vertical construction

Rotating Element—Only 2 Moving Parts!

Write for "Hydrex Pump Reply Sheet." Reverse side can be filled in for prompt quotation.

Founded 1905 — Member A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

9261 Hudson Blvd., North Bergen, N. J.

Sier-Bath Screw and "Gearex" Pumps for higher capacities and pressures . . . also mfrs. of Precision Gears and Flexible Gear Couplings.

(*To obtain more data on advertised products see page* 600)

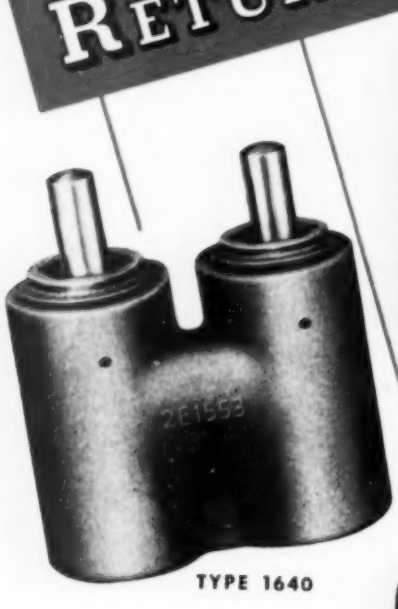
3 most popular OHIO RETURN BENDS

OHIO TYPE 1000: Adaptable to wide general use.

OHIO TYPE 1640: Ideal for high temperatures and pressures.

OHIO TYPE 2000: Designed for single tube replacement. The patented locking assembly eliminates the necessity for a rolling jig.

Descriptive pamphlets of any of the above designs will be mailed on request.



TYPE 1640

TYPE 1000

TYPE 2000

THE OHIO STEEL FOUNDRY COMPANY

LIMA, OHIO

PLANTS AT SPRINGFIELD AND LIMA, OHIO

What's New!

program, including petroleum, plastics, refractories, instrumentation, corrosion, chemical engineering, computers, and many other fields. Armour Research Foundation, Technology Center, Chicago 16, Ill.

Circle No. **25** *on Reply Card*

Flow Meters

. . . described in 7 new specification sheets, Nos. 241 through 247; including electric and mechanical evenly graduated bodies, square root flow meters, liquid level meters, inductance bridge receivers. Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Philadelphia 44, Penna.

Circle No. **26** *on Reply Card*

Automatic Chemical Feeding

. . . particularly for pH control or for feeding a treating chemical in direct proportion to primary fluid flow rate; four-page *Engineering Data Sheet No.* 000-10; technical details, flow diagrams. Foxboro Co., Foxboro, Mass.

Circle No. **27** *on Reply Card*

Water Treatment Pump

. . . of the controlled volume type; the H-20 positive displacement pump is designed for applications where extreme accuracy is not required; *Bulletin No. H-20-M*, with specifications and other data. Milton Roy Co., 1300 East Mermaid Lane, Chestnut Hill, Philadelphia 18, Penna.

Circle No. **28** *on Reply Card*

Fractionation Equipment

. . . for the laboratory; *Price List Form 4FE253* covers perforated bubble-plate columns, packing-type columns, concentric tube column units; liquid dividing and vapor-dividing automatic still heads, reflux condensers, timers, solenoids, and related accessories. Glass Engineering Laboratories, 581 O'Neill, Belmont, Calif.

Circle No. **29** *on Reply Card*

Stanford Research Institute

. . . and its work, covered in the *Annual Report for* 1952; 48 pages describing the physical facilities, the staff and administration, projects and clients of this west coast organization. Stanford Research Institute, Stanford, Calif.

Circle No. **30** *on Reply Card*

Condenser Tube Inserts

. . . for returning boiler heat exchanger equipment to operation by restoring tubes which have corroded and are leaking at the inlet. *Bulletin* 500. Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y.

Circle No. **31** *on Reply Card*

What's New!

Automatic Flowmetering

. . . for batching light or heavy liquids—asphalts, lubes, corrosives, etc.—illustrated, descriptive booklet *The Fluidometer*, Bulletin FL-49. Hetherington & Berner, Inc., 701 Kentucky Ave., Indianapolis 7, Ind.

Circle No. **32** *on Reply Card*

Pipe Tape Coatings

. . . of polyethylene plastic film; how they are applied, how to prepare the pipe; for under or above ground use in protection against corrosion; four-page folder on *Polyken*. Bauer & Black, 222 West Adams St., Chicago 6, Ill.

Circle No. **33** *on Reply Card*

Ultrasonic Energy

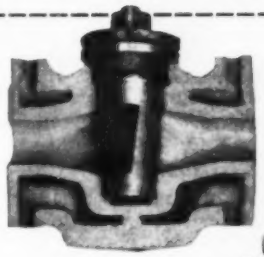
. . . its uses, special equipment, and technical details; covered in the booklets *Piezotronics*, Brochure CD 230001, and *Piezotronic Technical Data*, Technical Bulletin CD43001. Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.

Circle No. **34** *on Reply Card*

Centrifugal Pumps

. . . in 2, 3, 4, and 5-stage, split-case design; for head ranges to 1550 ft., capacities to 300 gpm in the

9 times out of 10



if it's jacketed
it's made by H&B

Above: Cutaway section of Jacketed cock, showing packing gland construction.

At Right: Jacketed 3-way Plug Cock.

Below: Jacketed meter, with set-back register, for measuring viscous liquids.

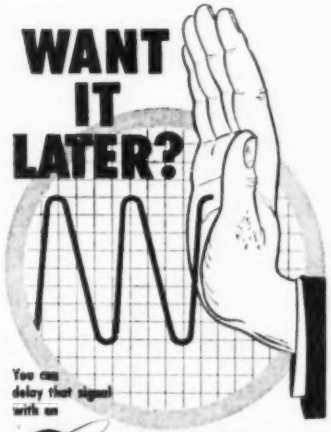
H&B ESTABLISHED 1887

Manufacturers of Jacketed Pipe, Fittings, Valves, Meters, Pumps, Hose, Etc.

Complete jacketed systems designed and engineered. Send for Bulletin J-50.

HETHERINGTON & BERNER INC.
751 Kentucky Ave., Indianapolis 7, Indiana

WANT IT LATER?



You can delay that signal with an

ERA

BOUNDARY DISPLACEMENT MAGNETIC RECORDING DELAY LINE

FREQUENCY RANGE—any five octave band between 5 cps and 30,000 cps, with appropriate drum speed. **DELAY**—up to 1000 wavelengths of information storage per channel; 200-second delay maximum at 5 cps—proportionately less with increase in frequency. **NUMBER OF CHANNELS**—1 to 16. **MAGNETIC DRUM NON-CONTACT RECORDING**—eliminates wear of recording medium; permanent drum recording surface may be used indefinitely. **BOUNDARY DISPLACEMENT TECHNIQUE**—provides a high degree of amplitude linearity; minimizes modulation effects due to non-homogeneity of recording medium or slight variations in head-to-drum spacing. **SEND YOUR DELAY LINE REQUIREMENTS to:**

Engineering Research Associates
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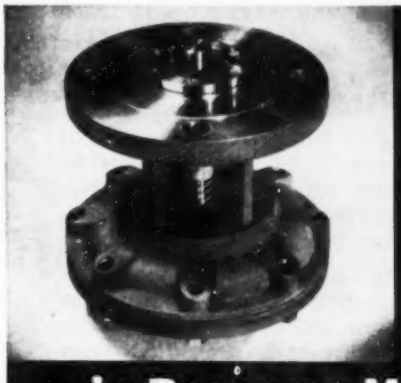

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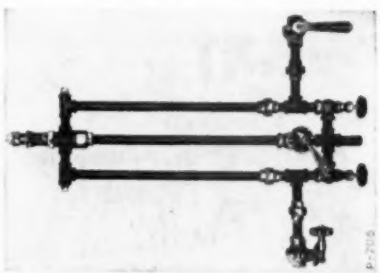

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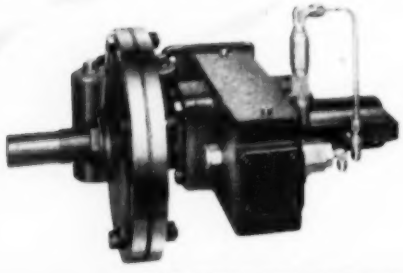

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What's New!

ACTIVATED ALUMINA, as a desiccant: Details; Aluminum Co. of America. See adv't p. 513.

ADDITIVES, all types, for motor fuels, lube and fuel oils: Information; Monsanto Chemical Co. See adv't p. 488.

ADDITIVES, inhibitor and detergent types, for lube oils: Information; Oronite Chemical Co. See adv't p. 608.

AIR COMPRESSORS: Bulletin L-675-B1B; Worthington Corp. See adv't p. 515.

AIR PREHEATERS: Complete details; The Air Preheater Corp. See adv't p. 570.

ALLOYS, nickel, for high temperature service: High temperature work sheet; The International Nickel Co., Inc. See adv't p. 485.

AUTOMATIC BLENDING, with differential unit: Descriptive literature; % Proportioneers, Inc. %. See adv't Inside Front Cover.

BURNERS, oil and gas: Bulletin 21; National Airoil Burner Co., Inc. See adv't p. 612.

CALIBRATING TANKS: Descriptive bulletin CT-102; Warner Lewis Co. See adv't p. 604.

CATALYTIC CRACKING UNITS: Information on engineering service; Refinery Engineering Co. See adv't p. 504.

CATALYTIC REFORMING: Complete details; The Atlantic Refining Co. See adv't pps. 474, 475.

CATALYST SUPPORTS, porous, refractory type: Information and samples; Norton Co. See adv't p. 482.

CATALYSTS, synthetic fluid type cracking, ground and microsperoidal form: Information; The Davison Chemical Corp. See adv't pps. 500, 501.

CHLORINATION EQUIPMENT, for slime control: Information; Wallace & Tiernan Co., Inc. See adv't p. 590.

DESALTING, electric: Complete information; Petroleum Rectifying Corp. See adv't p. 451.

DRUM CLEANING: Booklet F-7629; Oakite Products, Inc. See adv't p. 612.

ELECTRIC POWER SYSTEMS: Information; Westinghouse Electric Corp. See adv't pps. 456, 457.

ENGINEERING, as a career: Campaign Guide, The Advertising Council. See adv't p. 469.

EVAPORATORS, "Bentube", vertical and horizontal: Information; The Griscom-Russell Co. See adv't p. 493.

FILTERS, fluid: Bulletin No. 1152-P; Ronningen Manufacturing Co. See adv't p. 614.

FIRE PROTECTION, by foam systems: Quarterly magazine "Foam Facts", at no cost; National Foam System, Inc. See adv't p. 506.

FIRE PROTECTION, by sprinkler systems: 36-page booklet, "The ABC of Fire Protection"; Automatic Sprinkler Corp. of America. See adv't p. 578.

FITTINGS, forged steel: Literature; H. K. Porter Co., Inc. See adv't p. 596.

FITTINGS, welding: Catalog W-3; Bonney Forge & Tool Works. See adv't p. 594.

FLOW METERS, positive displacement type: Facts; Bowser, Inc. See adv't p. 582.

FLOW METERS, variable-area type: Complete information and Handbook; Fischer & Porter Co. See adv't p. 459.

GASHOLDER, dry seal: Information; General American Transportation Corp. See adv't p. 471.

GENERAL REFINERY EQUIPMENT, and for petrochemicals: Details; American Locomotive Co. See adv't p. 486.

HEATER, spray-type deaerating: "Trends in Application of Deaerating Heaters"; Graver Water Conditioning Co. See adv't p. 509.

HEAT EXCHANGERS, air cooled "fin-fan" type: Bulletin FF-7; The Fluor Corp., Ltd. See adv't p. 508.

HEAT EXCHANGERS, alloy, for corrosive and high-pressure conditions: Information, details; The M. W. Kellogg Co. See adv't p. 585.

HEAT EXCHANGERS, sectional "Fintube": Bulletin No. 512; Brown Fintube Co. See adv't p. 478.

HEAT TRANSFER UNITS: Bulletin HT-1; Schutte and Koerting Co. See adv't p. 487.

INHIBITORS, for aviation gasoline storage: Technical bulletin SC-52-32; Shell Chemical Corp. See adv't p. 519.

INSTRUMENT AIR DRYERS: Booklet, "Because Moisture Isn't Pink"; Pittsburgh Lectrodryer Corp. See adv't p. 505.

INSULATING, blanket: Bulletin 511; Forty-Eight Insulations, Inc. See adv't p. 583.

What's New!

INSULATION, for pipe: Information; Union Asbestos & Rubber Co. See adv't p. 494.

JACKETED SYSTEMS, for pumps, meters, pipe, fittings, valves, hose, etc.: Bulletin J-50; Hetherington & Berner, Inc. See adv't p. 611.

JET EDUCTORS: Bulletin 2-M; Schutte and Koerting Co. See adv't p. 487.

LIQUID LEVEL GAGES, non frosting: Literature; Jerguson Gage & Valve Co. See adv't p. 571.

MIST ELIMINATORS, knitted wire mesh: Bulletins; Metal Textile Corp. See adv't p. 444.

MIXING, side and top entering, also laboratory types: Catalogs; Mixing Equipment Co., Inc. See adv't p. 520.

PAINT, rust preventive: Complete literature; Rust-Oleum Corp. See adv't p. 507.

PRESSURE TRANSMITTER, in the micro range: Bulletin 154; Askania Regulator Co. See adv't p. 614.

PRESSURE TRANSMITTER, pneumatic: Bulletin P-2520; Conoflow Corp. See adv't p. 611.

PROCESSES, for refining: Information on "Perco"; Phillips Petroleum Co. See adv't p. 472.

PROTECTIVE COATING, corrosion-proof plus insulating: Name of nearest representative; Insul-Mastic Corp. of America. See adv't p. 446.

PROTECTIVE COATINGS, metal primers: Brochure B-769; The Sherwin-Williams Co. See adv't p. 591.

PUMPS, controlled volume: Complete information; Milton Roy Co. See adv't p. 574.

PUMPS, plunger type: Information; Oil Well Supply Div. of U. S. Steel Corp. See adv't p. 455.

PUMPS, positive displacement, with replaceable vanes: Bulletin 307; Blackmer Pump Co. See adv't p. 606.

PUMPS, rotary gear type: "Hydrex Pump Reply Sheet"; Sier-Bath Gear and Pump Co., Inc. See adv't p. 609.

REFRACTORY LININGS, hydraulic setting: Brochure RC-28A; Johns-Manville. See adv't p. 595.

REFRACTORY SHAPES, offu-ed stabilized zirconia: Bulletin 793; Norton Co. See adv't p. 482.

RETURN BENDS: Descriptive pamphlets; The Ohio Steel Foundry Co. See adv't p. 610.

STEAM TRAPS: Bulletin 152; W. H. Nicholson & Co. See adv't p. 601.

STUDS AND NUTS, continuous thread, quenched-carbon steel: Information; Bethlehem Steel Co. See adv't p. 566.

TOWER PACKINGS: Sumpes and technical data; The U. S. Stoneware Co. See adv't p. 496.

TRANSMITTERS, differential pressure: Complete information; Taylor Instrument Companies. See adv't pps. 560, 561.

TUBE CLEANERS: Literature; Airetool Manufacturing Co. See adv't p. 577.

TUBE EXPANDING MACHINE, automatic: Bulletin TX-50; Vernon Tool Co., Ltd. See adv't p. 575.

TUBES, refractory, seamless, alundum: Bulletin 140; Norton Co. See adv't p. 482.

TUBING, alloy: Bulletin TR-516; The Babcock & Wilcox Co. See adv't p. 503.

TURBINES, gear, close-coupled: Book B-3896; Westinghouse Electric Corp. See adv't p. 477.

TURBINES, steam, pump drives: Full details; Dean Hill Pump Co. See adv't p. 592.

VALVES, check, tilting disc type: Full details and prices; The Chapman Valve Mfg. Co. See adv't p. 484.

VALVES, combination pressure-vacuum vent, and flame arrester: Bulletin E-601; Black, Sivalls & Bryson, Inc. See adv't p. 605.

VALVES, control: Bulletin; The Annin Co. See adv't p. 517.

VALVES, diaphragm-motor control: Bulletin 700-2; Minneapolis-Honeywell Regulator Co. See adv't p. 495.

VALVES, general: Valve Catalog; W. S. Rockwell Co. See adv't p. 606.

VALVES, plug: Catalog 52-12-W; Wedgeplug Valve Co., Inc. See adv't pp. 510, 511.

VALVES, Venturi-Ball: Catalog 53; Crane Co. See adv't p. 465.

WATER CONDITIONING: Technical paper 123; W. H. & L. D. Betz. See adv't p. 497.

WATER CONDITIONING, to reduce corrosion, scale and algae: Information; Wright Chemical Corp. See adv't p. 613.

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EDITORIALS

The Future of Synthetic Rubber

THE recommendation to Congress by the Reconstruction Finance Corp., that the government dispose of its synthetic rubber manufacturing facilities to private industry will have the approval of the petroleum industry.

Introduced to meet a great wartime emergency, growing acceptance of the synthetic product has taken place in the postwar years. In 1952 the output of all types of synthetic rubber was nearly 800,000 long tons, close to the volume of natural rubber imported. Maximum wartime production of synthetic was around 815,000 tons.

The oil companies' participation in the government's current synthetic rubber program is through operating eight of the 10 plants supplying butadiene to the copolymer plants, and two butyl rubber units, and an oil company runs one of the 13 copolymer plants. The oil companies along with the rubber companies have been responsible for the greatly improved technology achieved by this new industry in a period of a few years. Supplying the components for synthetic rubber, butadiene and styrene, is a development in the field of petrochemicals in which many refiners are now taking an active interest.

The government spent $675,000,000 on the synthetic rubber manufacturing facilities, a reasonable investment to free the nation from sole dependence on the natural product. Under their operation by the petroleum and rubber companies chiefly, wartime needs were met and large-scale peacetime uses have been established. It is now time for the government to step entirely out of the picture and sell the plants to private capital under conditions that will stimulate further growth and progress of the synthetic rubber industry.

The Facts Speak Differently

MODERN trends in refinery and gasoline plant construction and operation increase the hazards to workers, O. A. Knight, president of the CIO Oil Workers International Union, charged in a talk before the California State Safety Conference. "New techniques create new hazards," he said. "Dangerous acids are being used in refining. . . . The equipment with which petroleum is processed is increasing in size and complexity, with a resulting increase in the danger of leaks, explosions and fires, and the magnitude of explosions and fires when they do occur."

Automatic control apparatus while reducing manual labor, he said, increased accident risks because fewer men were present to meet the hazards from fire and explosions.

As is commonly the case when such charges arise from labor union leaders, Knight presented no facts to back up his claim of greater risks to workers because of the present trend in plant construction and operation. There is ample data, however, to prove that what he said is 100% wrong. The Department of Statistics of the API, in cooperation with the National Safety Council, collects statistics on accidents from over 300 oil companies, including most of the refining concerns. Its data show convincingly the decline in injury rates in the refining plants.

The injury frequency rate (number of disabling injuries per 1,000,000 hours worked) dropped from 10.53 in 1946 to 7.17 in 1951; the severity rate (number of days lost per 1000 hours worked) dropped from 1.62 to 1.15. It was in this period that the size of processing units increased and other technological improvements took place, to which Knight objects on the grounds of increased danger to workers.

Imports and Refining Economics

ENTIRELY different conditions apply in the consideration of arbitrary limits on residual fuel oil imports than apply on restrictions on foreign crude oil brought into the country. But few of the arguments coming out in the present controversy set up any distinction between the two matters.

Bunker C fuel oil is imported to supplement the supply available from domestic refining sources in the eastern and New England areas of largest consumption of this product. Such imports are brought in in large volume by only three oil companies, and their refining operations are geared around their supplying also the imported product. Without imports, refineries in this area would have to run more crude to supply the volume of heavy fuel oil needed for ships' bunkers and industrial consumers who prefer to use oil. The expanded refining operations might dislocate the supply-demand relationship of other refined products.

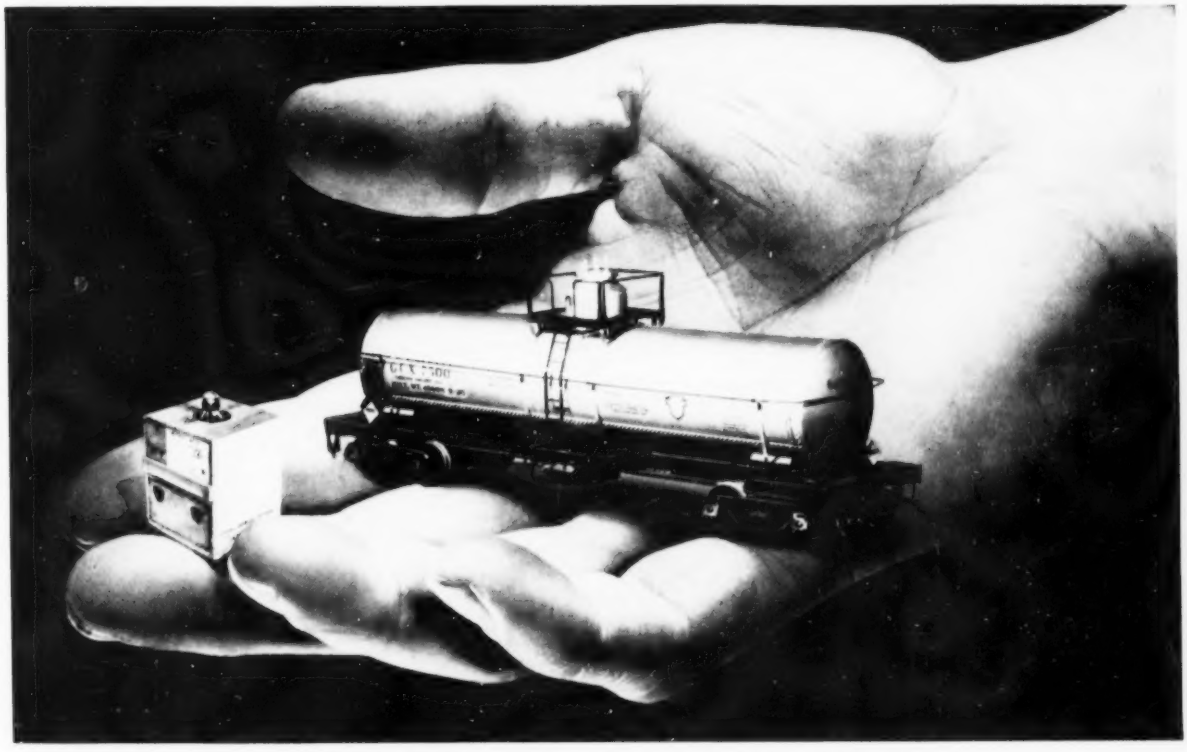
Freight rates present a barrier against any movement of imported heavy fuel any distance in from the East Coast, where it would come into competition with this product from interior refineries. The distress of the interior refiners over their residual fuel oil markets is due more to the present competition of natural gas in their territories than to that of imported oil, and to their earlier loss of the fuel oil business of the railroads.

The long range economic trend has been for refiners to reduce their yields of residual, and increase their yields of the products which bring a higher realization from the crude oil they process. The return from heavy fuel oil is declining in relation to the return from the superior primary products. An arbitrary restriction on fuel oil imports might halt or even reverse this trend, for the time being, by bringing about a higher price for the residual product. In the long run, however, it is a question whether it is not to the refiner's advantage to continue to reduce his yield of heavy fuel oil, which must basically sell in competition with coal, and to improve his output of primary products.

* * *

Once a scientist always a. . . . The business over the luncheon table had been concluded and the conversation turned to irrelevant topics and finally came around to the respective merits of drinking coffee hot or cold. The visitor emphasized the habit of one of his friends: "Why, he drinks it regularly at from 135° to 140° F."

use acids?



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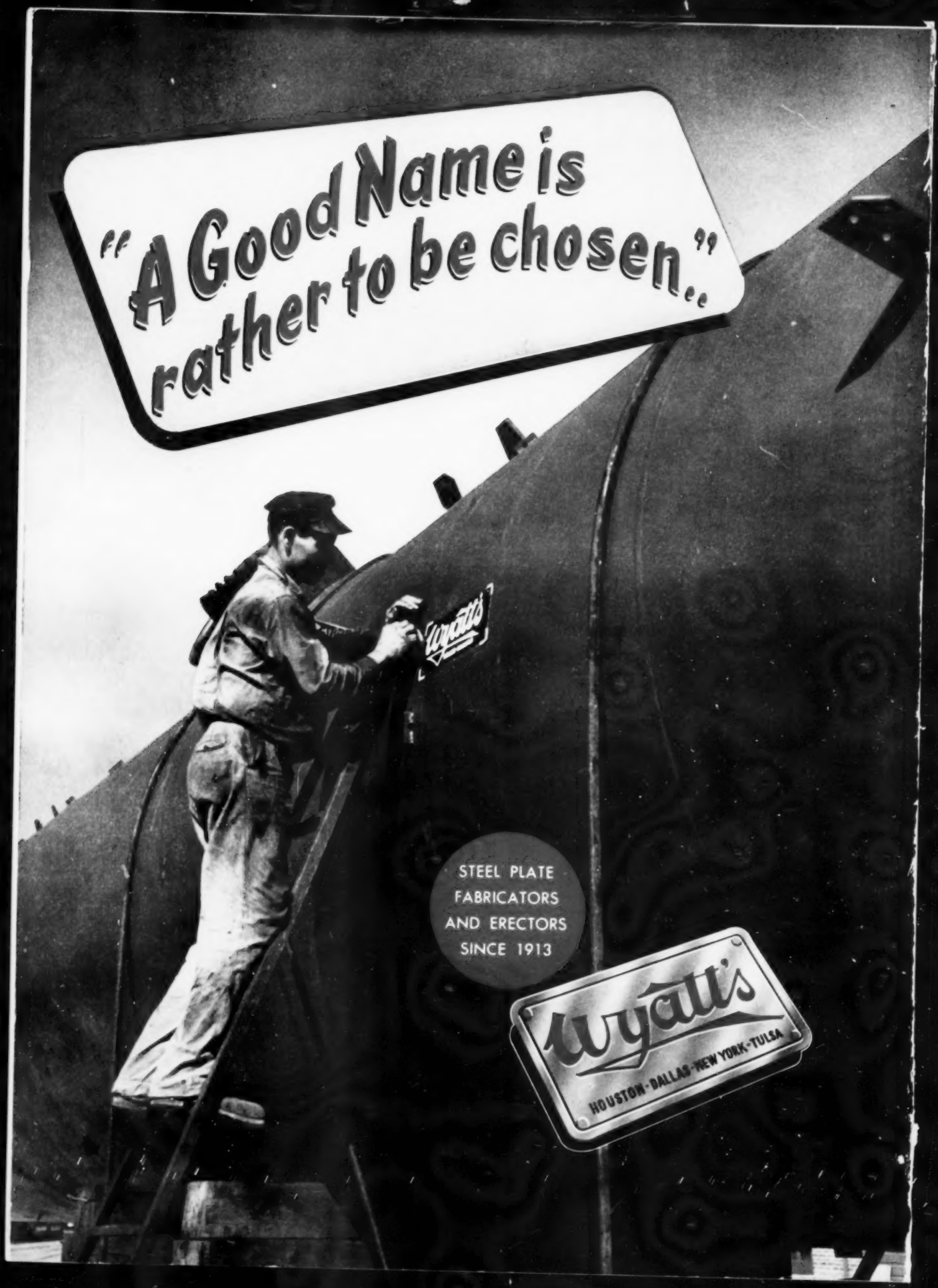
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